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Individualized Science Instructional System

Managing ISIS

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FOREWORD

Evidence has been mounting that something is missing from secondary science teaching. Increasingly, students are rejecting science courses and turning to subjects that they consider to be more practical or significant. Numerous high school science teachers have concluded that what they are now teaching is appropriate for only a limited number of their students.

As their concern has mounted, many science teachers have tried to find instructional materials that encompass more appropriate content and that allow them to work individually with students who have different needs and talents. For the most part, this search has been frustrating because, presently, such materials are difficult, if not impossible, to find.

The Individualized Science Instructional System (ISIS) Project was organized to produce an alternative for those teachers who are dissatisfied with current secondary science textbooks. Consequently, the content of the ISIS materials is unconventional, as is the individualized teaching method that is built into them. In contrast with many current science texts that aim to "cover science," ISIS has tried to be selective and limit the coverage to the topics that we judge will be most useful to today's students.

Obviously, the needs and problems of individual schools and students vary widely. To accommodate the differences, ISIS decided against producing tightly structured, presequenced textbooks. Instead, we are generating short, self-contained modules that cover a wide range of topics. The modules can be clustered into many types of courses, and we hope that teachers and administrators will utilize this flexibility to tailor-make curricula that are responsive to local needs and conditions.

ISIS is a cooperative effort involving many individuals and agencies. More than seventy-five scientists and educators have helped to generate the materials, and hundreds of teachers and thousands of students have been involved in the Project's nation-wide testing program. All of the ISIS endeavors have been supported by generous grants from the National Science Foundation. We hope that ISIS users will conclude that these large investments of time, money, and effort have been worthwhile.

Ernest Burkman, Director
Individualized Science
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ABOUT THIS BOOKLET

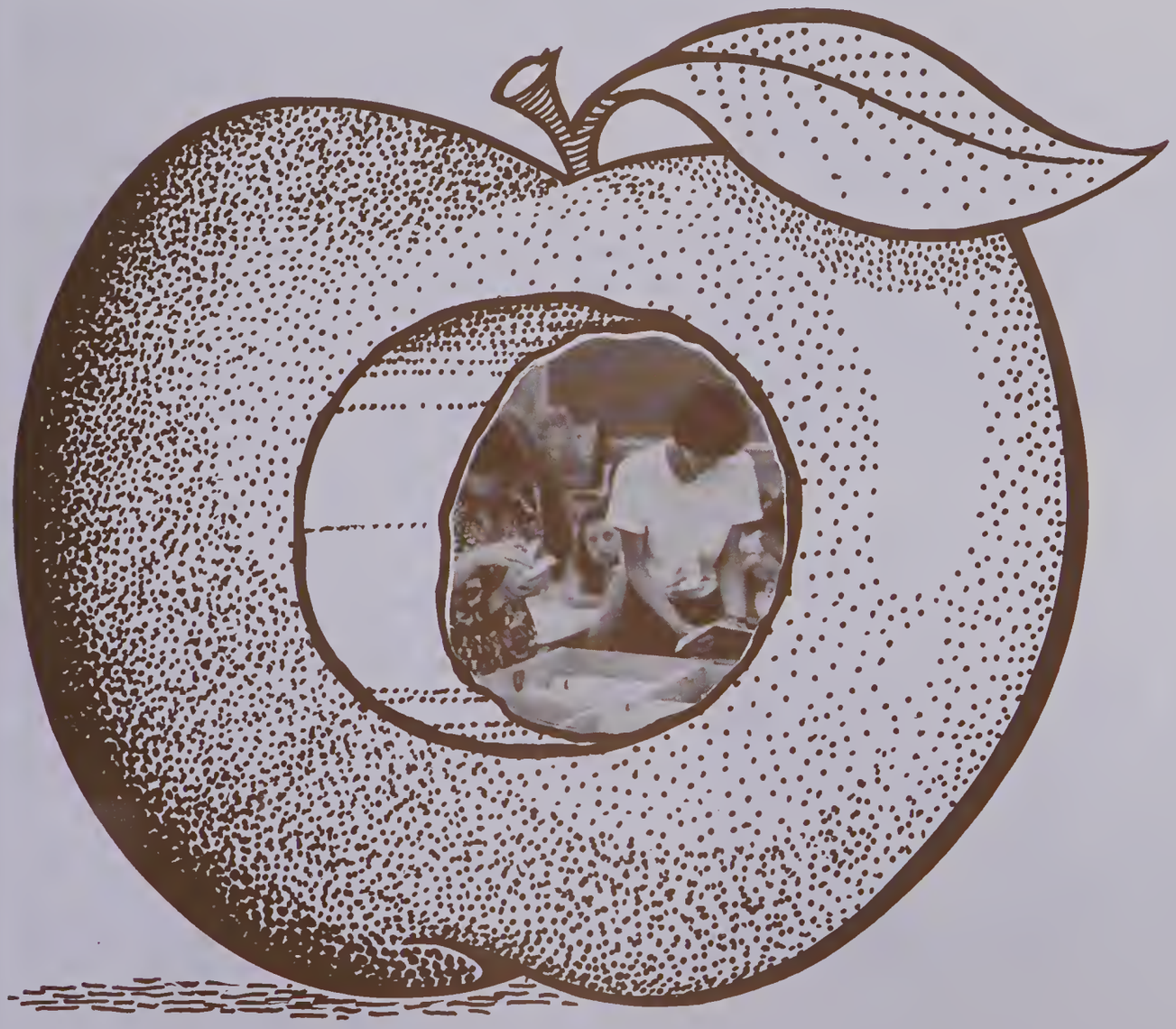
This booklet assumes that very soon you'll be using some of the instructional materials prepared by ISIS (the Individualized Science Instructional System). It also assumes that you're not quite sure what ISIS is like or what you'll need to do to get ready to teach it. Hopefully, you will find quick answers to these questions in this booklet.

The booklet is designed more as a reference than as something to be read from cover to cover. Here's the way to use it to maximum advantage.

First, carefully read through "Part 1: Getting Started." It explains the things you'll need to know and do to get an ISIS class smoothly under way. It also lists what you'll need to do over the long haul in order to keep things moving as they should.

As you read through Part 1, you'll frequently be referred to sections in Parts 2 through 8. Those seven parts present concrete alternatives for coping with the problems you are likely to encounter. Ignore those references in your first reading. When you finish reading Part 1 once, go back through it again, find the references to later parts, turn to the appropriate pages, and read them. It is not necessary to read all of Parts 2 through 8 in one sitting.

More than likely, you'll make the heaviest use of *Managing ISIS* just before and just after the opening of school. But keep it handy throughout the school year to use as a reference for solving specific problems that may come up from time to time. A detailed index has been included at the end of the booklet to facilitate that kind of use.



PART 1: GETTING STARTED

This part will get you going in the ISIS program. And it will give you easy access to the rest of the parts in the book. Read it through carefully.

First Planning Priorities

The key to good ISIS teaching is planning and organization. And the key to good planning is to get started early. This section spells out the things you'll need to do before your students arrive in order to get under way smoothly. For convenience and efficiency, the essentials of preschool planning are listed below as a series of step-by-step instructions.

1. Try to get a mental picture of what good ISIS teaching and good ISIS classrooms should be like. A quick look at "What's ISIS Like?" (pages 3 through 5) and a perusal of pages 50 through 52 of Part 8 should accomplish that.
2. Find out how ISIS minicourses are designed to work. The section entitled "Understanding ISIS Minicourses" (pages 5 through 7) describes how to do that.
3. Check your shipment of ISIS materials to be sure that it contains everything you'll need. Use this checklist.
   - at least one copy of *Managing ISIS* (this booklet)
   - multiple copies of several ISIS resource units
   - multiple student booklets and an ATE for each minicourse you ordered
   - multiple copies or spirit masters of each of two forms of the minicourse tests that accompany each minicourse you ordered
   - any ancillary items, such as audiotapes, games, and unique equipment, that may accompany the minicourses you ordered
4. Decide the number of minicourses you'll use at one time, the way you'll sequence them, and the ones your students will use first. See the section entitled "Choosing and Sequencing Minicourses" (pages 7 and 8) for information on the ways to make those decisions.
5. Quickly separate from your shipment the materials that you'll need immediately. Store the remainder.
6. Turn to the "Materials and Equipment" section of the ATEs for all minicourses that your students will use immediately. Be sure that you have everything that will be needed. Most materials should either have been included in your ISIS shipment or already be on your shelves, but you may have to gather a few items.
7. When you have everything needed for the initial minicourses, decide on a plan to organize your classroom. See Part 4 (pages 20 through 24) for several alternative suggestions. When you've made your plan, get your classroom set up.
8. Design a materials storage and retrieval system. See Part 5 (pages 25 through 32) for suggestions. Then store your materials according to your plan.
9. Establish laboratory safety procedures for your classroom and design a safety contract for students to sign. See the section entitled "Safety Provisions" (page 8) for immediate suggestions.
10. Decide the way you will administer tests and grade students. Keep in mind that you'll be testing individually, not in a group. Part 7 (pages 40 through 49) spells out the problems in testing and grading and suggests ways of handling them.
11. Decide how you will orient your students to your method of operating. Assemble any materials you will need for the initial orientation session. See the section entitled "Orienting Your Students" (pages 8 and 9) for a suggested orientation procedure.

The Next Priorities

When you have completed the eleven essential steps listed above, you will be ready to open school and operate for the first week or so. But there are some

remaining tasks that must be finished shortly after you are under way. These are listed below, and, if you have time, get them done before school opens.

1. Set up any testing areas that your testing plan calls for. Part 7 (pages 40 through 49) has suggestions. If your testing plan calls for using forms for recording scores, decide on a format and complete any necessary duplication.

2. Decide the ways you will monitor each individual student's progress. Part 6 (pages 33 through 39) has suggestions. If checklists, contracts, or other forms will be required, decide on their format and complete any necessary duplication. Also, decide the way you want your students to maintain their notebooks. There are alternatives on pages 53 through 56 in Part 8.

3. Decide whether you want or need to supplement the ISIS materials with other activities or materials. If enrichment is in your plans, decide how and when it will occur. See page 57 in Part 8 for suggestions on this topic.

4. Decide on a plan for ensuring that resource units will be readily available to students and a plan for encouraging their use. See page 30 in Part 5 and pages 56 and 57 in Part 8 for suggestions.

5. If you have students who lack basic reading skills, you need to face the problem early and decide what to do about it. Page 53 in Part 8 offers some thoughts on the subject.

What's ISIS Like?

Before you begin teaching ISIS, you should have a clear picture of what you're trying to accomplish. Here, very briefly, are some of the key elements of an ISIS classroom that is functioning according to the program's design.

Organized Classroom

A good ISIS classroom is organized so that students may quickly and easily locate, obtain, and return all of the equipment and materials they use. Students are taught to do this without disturbing other students and with a minimum of supervision from the teacher.

The Student

ISIS materials are appropriate for a wide range of students, but they are especially designed for those who are not science prone. This category, which comprises the majority of students now enrolled in high school, includes students who are not especially interested in science and who do not plan to major in science in college or enter a strongly science-related vocation. Below-average students using ISIS have been found to learn better in heterogeneous classes.

Individual Effort

ISIS students work individually or in small groups. Large-group instruction rarely occurs. The emphasis is upon helping each student to reach his or her maximum individual potential.

Varied Activities

Variety best describes an ISIS classroom. At any one time, depending upon their progress, students may be doing needed remedial work, studying and taking tests on different content, or engaging in advanced work all within one classroom. Although each student is held accountable for his or her work, the pace of learning varies with the interest, abilities, and future educational and vocational plans of the students.

Hands-On Activities

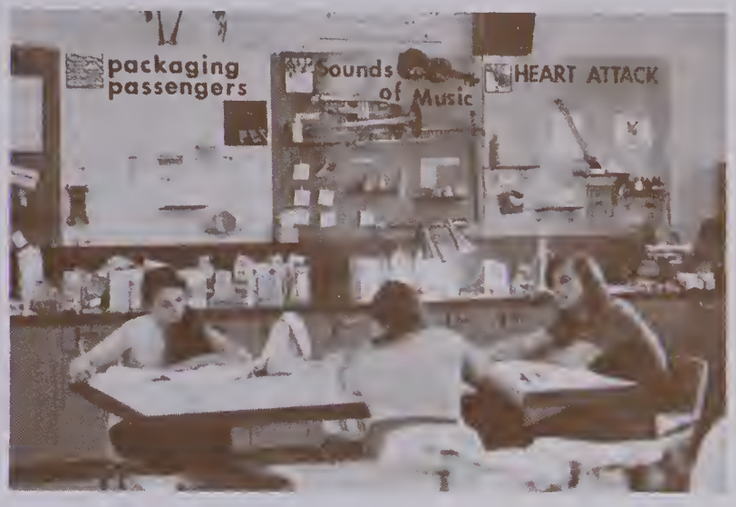
In ISIS, reading is often deemphasized in favor of hands-on experiences. ISIS students frequently handle objects, make direct observations, and investigate natural phenomena.

Personal Attention

Successful ISIS teachers move about the classroom interacting with their students. The teachers are constantly available to help individual students with problems and special interests. They provide on-the-spot monitoring of students' decisions as to which activities to do, the speed at which to work, and the time to move to a new topic.

Diverse Topics

The ISIS system includes a wide range of topics. These topics encompass applied science and the social implications of science, as well as a wide variety of intellectual skills and scientific principles.



Available Minicourses

Cells and Cancer	Plants Indoors	Things that Last
Heart Attack	Birth and Growth	Know Your Car
Getting Enough Oxygen	Actions and Reactions	Kitchen Chemistry
Gut Reactions	Buying and Selling	Physics of Sport
Generation Link	Stormy Weather	Fossil Fuels
Keeping Fit	Using the Skies	Sharing the Earth
Know the Bug	Sounds of Music	Eye and Vision
Food and Microorganisms	Household Energy	Human Reproduction
Snakes and Other Critters	Packaging Passengers	It's All Air
Let's Eat	House Power	Nerves in Action
Ways We Learn	Fire!	Touch the Earth

Understanding ISIS Minicourses

A first step in becoming a good ISIS teacher is to find out how ISIS minicourses are designed to work. Later, you will have the problem of orienting your students to the same thing.

Get an ATE for one of the minicourses you plan to use (except *Actions and Reactions,* which has a unique format). Then follow the steps outlined below.

1. Turn to page 1 and read "What's It All About?" That section appears in all minicourses and is designed to give the student a quick overview of the topic to be covered.

2. Turn to "Activity 1: Planning." This section is the core planning activity and always follows "What's It All About?" It performs two functions. First, it details the content that all students are expected to learn. Second, it provides a mechanism to enable a student to decide whether he or she already knows some of

the required content and should skip a section. To see the way students decide whether or not to skip, do the following.

a. Read the one or more objectives for Activity 2. Any student who does not feel confident of the objectives is expected to do Activity 2. Those who think they know the objective should do *b*.

b. Try to answer the sample question for each objective, and check the answer against the one given at the bottom of the page. An incorrect answer means the student should do Activity 2. A correct answer means the student should do *c*.

c. Turn to Activity 2 and scan it. Notice that some of the questions are starred. Try to answer the starred questions. Inability to answer the starred questions or doubt about the activity's content means the student should do Activity 2. Correct answers with confirmation by the scan mean that the student should skip Activity 2.

3. Return to "Activity 1: Planning." Check yourself on Activity 3, following the procedure outlined in Step 2 (page 5). An ISIS student would continue this procedure through the entire core planning activity. The result would be a list of the activities he or she must do and a list of those that can be confidently skipped. Then the student does all the activities on the "must-do" list.

4. Get copies of Forms A and B of the test for the minicourse you are examining. Take the core part of one of the two tests to get an idea of the type of questions included. When an ISIS student completes all of the "must-do" activities for the core, he or she asks the teacher for the core test. The teacher then assigns either Form A or Form B. If the student doesn't meet the teacher's standards for the test, he or she goes back for further study and later takes the other form.

5. Turn to the advanced planning activity. (The number of the activity will vary depending on the minicourse, but the activity will be somewhere in the middle of the booklet.) This planning activity is to be used exactly as the one for the core. Use the objectives and sample questions in the planning activity along with starred questions and a scan of one or more advanced activities to assess your prior knowledge of advanced-activity content. Note that advanced activities are supplemental to the core activities and are designed to be done by students who (1) are good at or interested in science, (2) plan to enter college, or (3) plan to enter a science-related vocation. These students should be encouraged to do the advanced planning activity and any of the advanced activities that classify into the "must-do" category.

6. Look at the advanced activity section of Form A and Form B of the test for the minicourse you are examining. When those students who do the advanced activities complete their work, they report to the teacher and are given either Form A or Form B of the test. If they do not meet the teacher's standards, they go back for further study. If they do satisfactory work on the test, they either go to the excursion planning activity or on to the next minicourse.

7. Turn to the excursion planning activity. (The number of this activity will vary depending on the minicourse, but the activity will be about two-thirds of the way through the booklet.) Notice that this planning activity has no objectives or sample questions. Students select excursion activities solely on the basis of descriptions included in the planning activity. As you scan the excursion activities, note that their difficulty level is lower than that of the advanced activities. These activities are supplemental to the core activities and are designed for students at any ability level.

8. Look at the excursion activity section of Form A and Form B of the test for the minicourse you are examining. When those students who do the excursion activities complete their work, they report to their teacher and are given either

Form A or Form B of the test. If they do not meet the teacher's standards, they go back for further study. If they do, they either go to the advanced planning activity or to their next minicourse.

9. Scan the minicourse booklet until you find one of the references to a resource unit. You will have to look carefully because the references are built right into the text. Get the resource unit that you found referenced. Notice that the content of the unit fits into the topic being discussed at the point of reference. Resource units are optional and supplementary and are designed to provide remedial help with content or skills that some students may not have.

Please note that the preceding summary of how ISIS minicourses are designed to work has been very limited. ISIS strongly recommends a thorough perusal of several minicourses to anyone planning to use minicourses.

Choosing and Sequencing Minicourses

With very few exceptions (such as *Actions and Reactions*), ISIS minicourses are designed to be used in any order. This feature allows you to choose both the order in which minicourses are done and the number of minicourses that are under way at a given time.

ISIS recommends that at the beginning of the school year you choose three minicourses and allow your students to work on them simultaneously. Assuming you have thirty students in a class, this would mean that ten students would start with each of three minicourses.

ISIS also recommends that you allow students to choose which of the three minicourses they will start with and that all students be required to complete the full set of three minicourses, although in variable order. The recommended procedure for accomplishing this is as follows. (The plan assumes thirty students per class.)

1. Prior to the opening of school, choose the three minicourses with which you will begin. Design your initial classroom organization and materials storage and retrieval systems around these minicourses.
2. On the first day of class, make available to your students ten copies of each of the three minicourses you selected. Within the constraint that ten students must work on each minicourse, allow your students to choose from the three the minicourse they wish to start with.
3. As students complete a minicourse, have them trade with a classmate. Continue this trading until all students have done all three minicourses.
4. When the first student has completed all three minicourses, put out ten copies of a fourth title and add the necessary materials to your storage and retrieval system.
5. As soon as all students have completed any one minicourse, remove the booklets and all related materials.
6. Continue adding and subtracting minicourses to and from your classroom according to your students' working pace. Try to have three titles in use at all times, and be careful not to get more titles under way than you can comfortably manage. (For most teachers, more than five minicourses creates an unmanageable situation, but some teachers have successfully used twelve at one time.)

ISIS recommends that three criteria be used in selecting the three minicourses with which to begin. First, choose topics with which you feel comfortable. Having to learn new content just ahead of your students is not the best way to begin the year. Second, choose topics likely to be of interest to most of your students and definitely within their capabilities. You want motivation to be as high as possible while you and the students are adjusting to ISIS. Third, pick minicourses that are not likely to overwhelm you with management problems. It will be easier to have fewer total pieces of apparatus and fewer items that are called for in multiple activities or that require extensive advance preparations. But keep in mind that minicourses emphasizing reading can be discouraging to some students.

There are two primary reasons for the suggestion that you begin with three minicourses rather than one. Field trials have indicated that giving students some choice, even if limited, motivates them and gives them a degree of independence. Also, using three minicourses at a time cuts the cost of purchasing booklets and nonconsumable materials to one-third.

Of course, there are other ways of getting the school year started and your circumstances may mean that another way will work better than the one suggested. To learn about some of the alternatives, turn to Part 2 (pages 10 through 14).

Safety Provisions

There are two reasons for being concerned about classroom safety. First, the welfare of your students often depends upon good safety habits and procedures. Second, you as a teacher have legal responsibilities when it comes to protecting your students from possible harm. To meet both your moral and your legal responsibilities, ISIS recommends that you set up the following safety procedures.

1. In organizing your classroom, keep safety in mind. (See Part 3, pages 15 through 19, for tips about how to do this.)
2. Draft a detailed list of the safety rules that you expect your students to follow. Reproduce the list, and give every student a copy. After a discussion of it, make sure that the lists are kept permanently in the students' notebooks. If it is impossible in your classroom situation to reproduce a copy for each student, post the list permanently in a prominent place. Part 3 lists many suggestions about safety.
3. Monitor your students' behavior continually.
4. Prepare a safety contract, and have each student sign one. The thrust of the contract should be that the student understands your safety rules and agrees to abide by them. Below is a sample of such a contract. (ISIS does not certify the legal implications of the sample contract. If these are of concern, consult an attorney.)

Safety Contract

I have been given a copy of the safety rules that are to be observed in ____(teacher's name)____ classroom. I understand the rules and agree to observe them. I also agree to observe any and all additional safety rules and precautions that appear in writing in the instructional materials to which I am assigned.

(student's signature) _____

(date) _____

Orienting Your Students

The first few days of an ISIS class will set the tone for the entire year because students' work habits form during this time. This section describes the things that should happen during the first three to five days. The plan assumes that prior to the opening of school, you will have completed the eleven-step preschool organizing procedure that is spelled out on page 2.

To carry out the suggested orientation activities that follow, you will need these materials.

- at least ten copies of the three minicourses that students will do first (see pages 7 and 8)
- at least one copy of your safety rules and two copies per student of your safety contract (see page 8)

By the end of the third day, but no later than the end of the fifth day of class, all of your students should be working comfortably in their first minicourse. For this to happen, your students need to learn two things. They must know how minicourses work, and they must know how you plan to operate. The activities listed below will achieve those goals. The order in which the activities are done can vary according to your local situation and your preferences.

How minicourses work. Distribute copies of one or more regular minicourses and use these as the basis of a discussion about how minicourses work. (See pages 5 through 7, "Understanding ISIS Minicourses," for ideas about how to organize such a discussion and what to emphasize.)

Safety. Explain your safety rules, and demonstrate them where appropriate. Give students a list of the rules to be kept for reference, or post a list in a prominent place. Have your students sign a safety contract acknowledging that they know the rules and plan to follow them.

Students' responsibilities. Explain your ground rules for students' responsibilities and classroom behavior. You may want to establish a contract for this area as well as for safety.

Storage areas. Point out where you have located equipment, materials, chemicals, audiotapes and players, resource units, and special materials and equipment. Explain the procedures for obtaining, using, and returning these materials.

Testing and grading. Explain your procedure for giving tests and arriving at grades. Be sure that everyone understands the ground rules for the reward system.

Notebooks. Explain to your students that they will need a notebook, and tell them the way you wish their answers, tables and graphs, and other written reports to be kept.

Overview of minicourses. Explain which minicourses are available. Show students copies of them and briefly describe them. The ATE for each minicourse gives an overview, and another good preview of the topic appears in the section called "What's It All About?" in the minicourse booklet.

Selecting Minicourses. Give students a few minutes to browse through the available minicourses. Having previously perused them yourself, you may want to give them some pointers about how to make their selections.

PART 2: SEQUENCING MINICOURSES

At least four factors may bear on your deciding the order in which students will do minicourses. First, there may be disciplinary requirements, such as the desirability of learning something about cells before studying genetics. Second, variations in interests, abilities, and vocational plans may indicate that sequence should vary with the student. Third, financial and other constraints may limit the number of minicourses available and hence possible sequencing. Finally, you may want to take advantage of the increased motivation that accompanies giving students choice as to what they study.

Part 1 of this booklet recommends a procedure whereby all students in a class would do the same minicourses during the school year, but each student would be given some choice as to the order in which minicourses are done. (See pages 7 and 8.) However, your circumstances may be such that the recommended approach is not appropriate. The table in Figure 2-1 below summarizes five alternative ways of handling the sequencing problem and Figures 2-2 through 2-7 (pages 11 through 13) display how each works.

OPTION	HOW IT WORKS	ADVANTAGES	DISADVANTAGES
A. All students start with the same minicourse and do subsequent minicourses in a prescribed order.	You choose the minicourses to be done and distribute them in order.	The class begins with a minicourse whose subject you know well. Only one set of materials must be distributed and maintained. Limited content is easily monitored. The sequence is predictable.	Intense use of the same equipment and materials means quantities must be large (cost increases). Selected topics or sequence may be inappropriate to many students.
B. All students start with the same minicourse. After about three weeks, the original minicourse is replaced by two or three minicourses to increase options.	You choose the minicourse to be done first, and then let students choose from a very limited number after that.	See Option A above for the first three weeks. The class begins with as few variables as possible. Later, students have increased options. Cost effectiveness is improved after the early weeks.	See Option A above for the first three weeks — reduced later. Management becomes more complicated after the third week. (See Option C below.)
C. Students choose from three minicourses. The sequence varies with the students.	You choose a group of minicourses to be done. Students choose a sequence from the booklets available.	Students start with a minicourse of interest. Fewer students use the same equipment at the same time — quantities are smaller and cost is lowered. Interest in other minicourses is created when students see what others are doing. Cost is reduced substantially.	More different materials are needed simultaneously. More time is required for locating and preparing materials. Allotment of work space and management of materials is more complicated. Work must be monitored in more than one content area. Sequence is unpredictable.
D. Students choose from five or six minicourses. The sequence varies with the students.	See Option C above.	See Option C above. Cost is reduced even further.	See Option C above.
E. Students have total flexibility in sequence.	You set out all minicourses for the year. Students choose and work in the order they wish.	Maximum choice results in maximum motivation. Cost is minimized.	Equipment needs are not predictable. Everything must be available simultaneously. Management of materials is extremely complex. Maximum content variety must be monitored. Sequence is completely unpredictable.

Figure 2-1

Figures 2-2 through 2-7 display the five sequencing options (Options A through E) and one variation on Option C. The figures show how different numbers of minicourses might be sequenced among nine students during one nine-week period. Minicourses are represented by the capital letters in the tables.

WEEK	STUDENT 1	2	3	4	5	6	7	8	9
One	A	A	A	A	A	A	A	A	A
Two	A	A	A	A	A	A	A	A	A
Three	A	A	A	A	A	A	A	A	A
Four	B	B	B	B	B	B	B	B	B
Five	B	B	B	B	B	B	B	B	B
Six	B	B	B	B	B	B	B	B	B
Seven	C	C	C	C	C	C	C	C	C
Eight	C	C	C	C	C	C	C	C	C
Nine	C	C	C	C	C	C	C	C	C

Figure 2-2

Notice that in Figure 2-2 above, which displays Option A, all students do the same minicourse at the same time. Only one minicourse is available to students in each three-week period.

In Figure 2-3 below, which displays Option B, the pattern is the same as in Figure 2-2 for the first three weeks. But after that, students have limited options in sequencing the minicourses. Note that no more than three different minicourses are in use in the classroom at one time.

WEEK	STUDENT 1	2	3	4	5	6	7	8	9
One	A	A	A	A	A	A	A	A	A
Two	A	A	A	A	A	A	A	A	A
Three	A	A	A	A	A	A	A	A	A
Four	B	B	B	B	C	C	C	C	C
Five	B	B	B	B	C	C	C	C	C
Six	B	B	B	B	C	C	C	C	C
Seven	C	C	C	D	D	D	B	B	B
Eight	C	C	C	D	D	D	B	B	B
Nine	C	C	C	D	D	D	B	B	B

Figure 2-3

As Figure 2-4 below shows, students under Option C have limited sequencing options from the beginning. This figure displays the usual pattern for Option C and is the sequencing procedure recommended in Part 1 (pages 7 and 8). Three minicourses are in use in the classroom at one time. The number of choices a student has decreases during each three-week period.

WEEK	STUDENT								
	1	2	3	4	5	6	7	8	9
One	A	A	A	B	B	B	C	C	C
Two	A	A	A	B	B	B	C	C	C
Three	A	A	A	B	B	B	C	C	C
Four	B	B	B	C	C	C	A	A	A
Five	B	B	B	C	C	C	A	A	A
Six	B	B	B	C	C	C	A	A	A
Seven	C	C	C	A	A	A	B	B	B
Eight	C	C	C	A	A	A	B	B	B
Nine	C	C	C	A	A	A	B	B	B

Figure 2-4

Figure 2-5 below shows one variation of Option C. In this case, students always have at least three minicourses to choose from, and the total number of minicourses in use in the classroom at one time will increase.

WEEK	STUDENT								
	1	2	3	4	5	6	7	8	9
One	A	A	A	B	B	B	C	C	C
Two	A	A	A	B	B	B	C	C	C
Three	A	A	A	B	B	B	C	C	C
Four	B	B	B	A	A	C	D	D	D
Five	B	B	B	A	A	C	D	D	D
Six	B	B	B	A	A	C	D	D	D
Seven	C	C	D	D	E	E	E	A	A
Eight	C	C	D	D	E	E	E	A	A
Nine	C	C	D	D	E	E	E	A	A

Figure 2-5

Figure 2-6 below displays Option D with five minicourses at one time in use in the classroom.

WEEK	STUDENT								
	1	2	3	4	5	6	7	8	9
One	A	A	B	B	C	C	D	D	E
Two	A	A	B	B	C	C	D	D	E
Three	A	A	B	B	C	C	D	D	E
Four	B	B	C	C	D	D	E	E	A
Five	B	B	C	C	D	D	E	E	A
Six	B	B	C	C	D	D	E	E	A
Seven	E	C	D	D	B	B	A	A	C
Eight	E	C	D	D	B	B	A	A	C
Nine	E	C	D	D	B	B	A	A	C

Figure 2-6

Figure 2-7 below displays Option E, which provides total flexibility. Students may sequence minicourses in many different ways.

WEEK	STUDENT								
	1	2	3	4	5	6	7	8	9
One	A	B	C	D	E	F	G	H	I
Two	A	B	C	D	E	F	G	H	I
Three	A	B	C	D	E	F	G	H	I
Four	B	A	D	E	F	G	H	I	C
Five	B	A	D	E	F	G	H	I	C
Six	B	A	D	E	F	G	H	I	C
Seven	C	D	E	F	G	H	I	A	B
Eight	C	D	E	F	G	H	I	A	B
Nine	C	D	E	F	G	H	I	A	B

Figure 2-7

Note that three weeks have been allotted in each case for each minicourse. A three-week period is an average time allotment. Some students will take more time and some less. And some minicourses will take more time than others.

Many other options are possible. Choose one that fits your style, your equipment limitations, your classroom situation, and the school's financial situation.

Monitoring Students' Choices

If you give your students some control over the minicourses they'll do, you will need to monitor the choice process. In particular, you need to be sure that students do not spend too much time working on minicourses that are obviously far below or above their ability level. To keep track of which student is doing which minicourse, you might use a minicourse choice form such as the one shown in Figure 2-8 below. This will help you quickly spot situations that need attention.

MINICOURSE CHOICE

Student _____ Date _____

Minicourses Completed

1.
2.
3.
4.

My next minicourse choice is

_____
_____
_____
_____

Figure 2-8

Another way to monitor students' choices is to keep a wall chart similar to the example shown in Figure 2-9 below. Such a chart will not only help you keep track of students' decisions, but it will also help you keep track of their progress through minicourses. And it will tell you when all students have finished a particular minicourse so that you can remove the equipment and booklets.

	MINICOURSE							
	Perception		*Packaging Passengers*		*Gut Reactions*		*Kitchen Chemistry*	
STUDENT	Date Begun	Date Finished	Date Begun	Date Finished	Date Begun	Date Finished	Date Begun	Date Finished
LUCY W.	11/2	11/23	10/8	10/28			9/12	10/6
CARLOS R.	1/10	1/25	9/12	9/26	9/27	10/15	12/10	12/23
LAURA F.			1/5	1/29	9/10	9/29	10/1	10/20
JIM H.	9/12	10/7			10/8	10/29	1/10	1/29
YOLINDA S.	11/2	11/20	10/9	10/25	1/10	1/29	9/12	10/6
BEATRICE V.	9/4	9/25	9/26	10/16			10/19	11/10
RONNY T.					1/4	1/22	9/4	9/25
MARTIN S.	9/12	10/7	11/2	11/22	10/8	10/29	12/15	1/10

Figure 2-9

PART 3: LABORATORY SAFETY

Safe practices involve precautionary measures, as well as prohibited acts. Although required safety measures and some of the things you must not do are presented in this section, it must be kept in mind that simply listing requirements and restraints misses the essential point.

Safety Discussions, Lists, and Posters

During the first week of ISIS, set aside time to discuss safety with your entire class. Prepare a detailed list of the safety rules you expect your students to follow. Reproduce that list, and give each student a copy. If that is impossible in your situation, make one list and post it permanently in a prominent place.

You may also wish to hang safety posters around your classroom. These posters should act as reminders to students. Figure 3-1 below shows examples of such posters. The posters should be changed fairly often, or they'll soon be ignored.

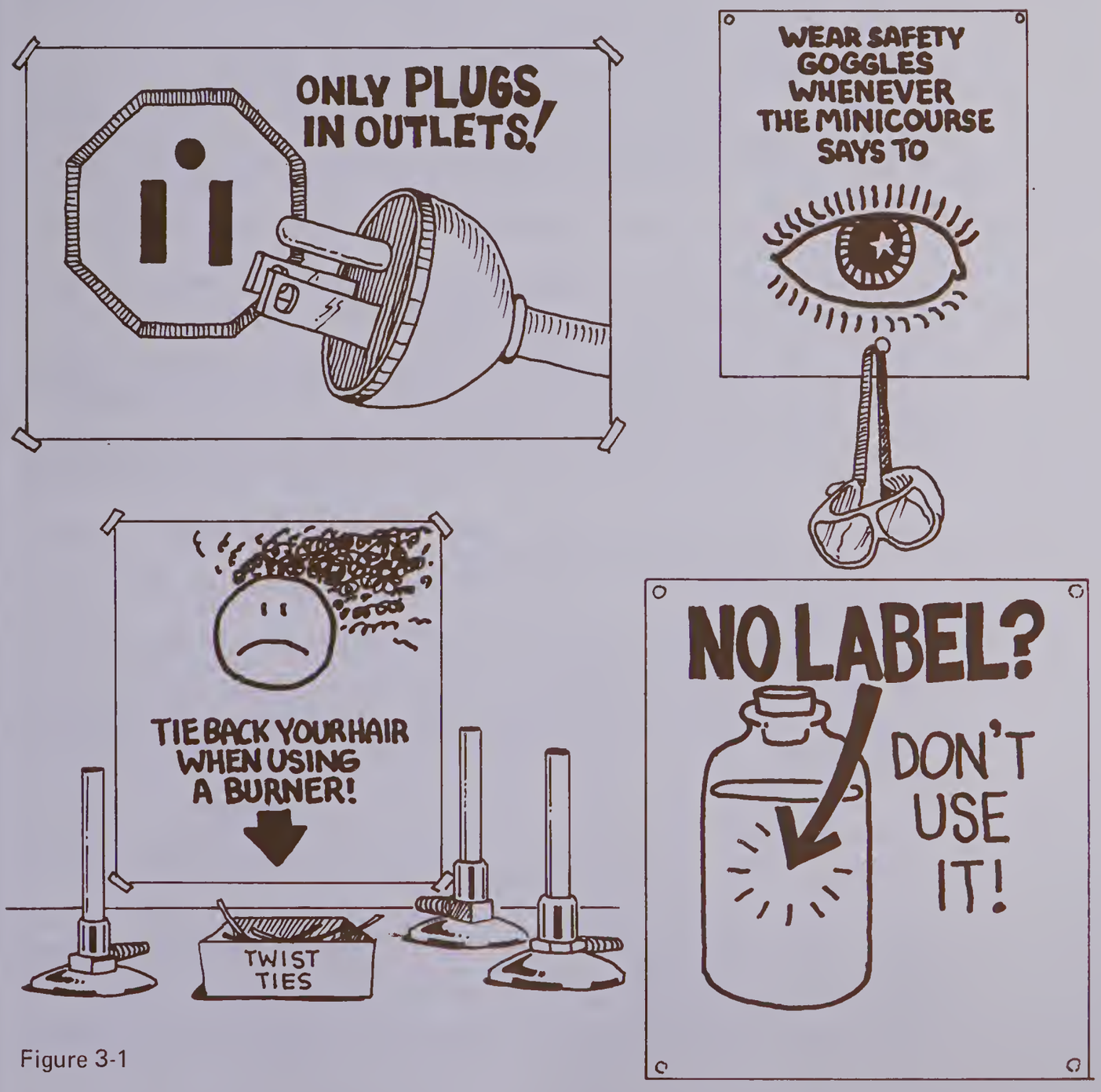

ONLY PLUGS IN OUTLETS!
WEAR SAFETY GOGGLES WHENEVER THE MINICOURSE SAYS TO
TIE BACK YOUR HAIR WHEN USING A BURNER!
TWIST TIES
NO LABEL?
DON'T USE IT!

Figure 3-1

Safety Rules

Here are twenty-six rules from which you can extract details for your class discussion on safety. You should also use the rules as a resource for making the list for your students and posters for your classroom.

1. Establish locations for safety devices (goggles, shower, fire blanket, eyewash, fire extinguisher, and others), and know how to use them. Make sure they are in good working condition and that passageways to each are always open and clear of obstructions such as chairs or tables. Invite students to criticize the present locations of these devices, not so much to make changes but to help them be aware of their location and accessibility.
2. Instruct students with long hair to tie it back when working with a burner or other open flame. Pipe cleaners, hair nets, twist ties, rubber bands, bobby pins, and string are useful. (During the class discussion, you might want to burn some human hair in an open flame to demonstrate its flammability. Pieces can be obtained from hairdressers or barber shops.)
3. Do not allow chemicals to be mixed or unassigned experiments to be performed without your approval. The activities in the ISIS mincourses have been tested and are safe if the directions are followed.
4. Don't let students use chemicals from an unlabeled container.
5. Instruct students to get the approximate amounts of chemicals they need at the supply area. Have them use a spatula, spoon, or wooden splint to remove solids. Tell them never to return unused chemicals and solutions to the stock bottles. Dispose of unused chemicals and solutions according to the directions given on pages 18 and 19.
6. Don't let students taste chemicals or bring them into contact with their eyes, nose, or mouth.
7. Have students wear safety goggles when activities call for them. (Most chemistry investigations require them.) If they are not wearing goggles, they should stay away from students who are doing investigations.
8. Require students to clean up spilled liquids immediately. They can use paper towels that have been thoroughly wet with water for cleaning up spilled acids and alkalies and then dispose of the towels properly.
9. Students should always point the open end of a test tube or flask away from themselves and others while heating the contents. They should never heat a closed container.
10. Students should discard wastes in special containers when instructed to do so by you or by the directions in the minicourse.
11. Students must be instructed to notify you immediately in case of an accident or chemical spills.
12. All students should carefully read and follow the safety directions and cautions that appear in minicourses.
13. Unless otherwise directed, students should heat liquids and solids only when they are in test tubes, beakers, evaporating dishes, or crucibles. Absolutely never heat a graduated cylinder, buret, dropper, or other container with or without a liquid or solid inside.
14. In case of fire, students should call you, get the fire extinguisher, and use it. (Fire extinguishers are available in several different types. A general-purpose fire extinguisher labeled "For use on Class A, B, and C Fires" is recommended.) Instruct your students in the proper use of the extinguisher.
15. In case of chemical spills or splashes in the eyes, have students get to the eyewash or water spigot immediately. Have another student call you. Have the student wash out the materials from the eyes with lots of running water, eyes open and blinking. Do not use pressure, and do not rub the eyes.
16. In case of spills and splashes on the skin or clothing, have the student wash the area with plenty of water. Have someone call you.

17. For all cuts and burns, students should notify you immediately. Even minor wounds can be serious. (Consult with your school nurse about the desirability of a first-aid station in or near the laboratory area.)
18. Instruct students never to insert anything into an electrical outlet except a plug designed for that purpose and properly connected to something they will be using.
19. Never allow students to stare at very bright light sources (including the sun), since their eyes can be damaged. Tell them never to look directly at any light source (including the sun) that emits ultraviolet radiation.
20. Instruct students not to place any object near the edge of a table or desk top where it can easily be knocked off. Even a small thing, such as a 100-gram weight, can do a lot of damage if it falls from a table top onto a toe or finger.
21. Any investigations involving noxious or dangerous fumes should be performed under a properly operating fume hood.
22. Students must carefully follow the rules, given in the minicourses involving radiation, for handling, using, and disposing of radioactive materials.
23. Maintain and have students use electrical equipment in such a way as to avoid shocks or short circuits from bare wires or unprotected contacts.
24. Use three-wire (grounded) electrical apparatus to guard against shocks from 110-volt circuits.
25. Do not let students open culture dishes unless instructed to do so. When any types of culture dishes are opened, avoid exhaling or inhaling near them. (Materials could be contaiminated, and organisms could be released.) Wash your hands thoroughly before and after handling culture dishes.
26. Provide only single-edged razor blades. Have students handle all dissecting tools very carefully. Students should return all razor blades and dissecting tools to their proper places as soon as they are finished using them.

Safety Contracts

ISIS strongly recommends the use of safety contracts. There are two good reasons for using them. The signing of a safety contract tends to make students more safety conscious. And students who are impressed with the need for safe practices tend to be better disciplined in their laboratory work. Suggestions for safety contracts are found on page 8.

Off-Limits Areas

In your room, set up certain areas that are off limits to students. Use these areas for storing hazardous equipment and chemicals, especially stock bottles of concentrated acids and bases, other corrosive, and poisonous substances. Store the stock bottles of corrosive liquids on the bottom shelves in the storage area or on the floor underneath the bottom shelf so they're less likely to be knocked over. Flammable liquids should be stored in fireproof cabinets and away from an open flame area.

Storage Area Inspections

Conduct inspections of the storage area regularly, and keep a log of such inspections. Also, check the conditions of fire extinguishers, fire blankets, safety showers, and eyewashes. Inspect the exhaust ventilation in hoods regularly to ensure proper ventilation. Check electrical cords for frayed insulation, exposed wires, and broken plugs and sockets. Repair these promptly.

Container Labeling

Label all bottles and other containers. The label must identify the contents, the concentration (of solutions), the date acquired or prepared, and, if prepared, the identity of the person who prepared it.

Unlabeled containers must be disposed of properly. Never use anything from an unlabeled container, and don't leave the container in your room. If you have no idea of the contents of a container, consult a chemistry teacher, a chemist at a nearby university or perhaps in a local industry, or your local fire department. Never dispose of an unknown chemical without getting help.

Preparing Solutions

When preparing solutions of acids, especially sulfuric, perchloric, and phosphoric, always add the acid to the water slowly and with continuous stirring. Don't add the water to the acid.

Mercury Spills

Do not allow students to handle or be exposed to mercury. Clean up mercury from broken thermometers by using a glass dropper and drawing the droplets into the glass tube. Then dust the area thoroughly with powdered sulfur. Clean up the sulfur.

Disposal of Materials

You will have to direct students about ways to dispose of various solutions and solids. Here are some general suggestions.

Acids, bases, other aqueous solutions: Wash them down the drain with lots of water unless the caution below applies.

Water-soluble solids: Dissolve them and then wash them down the drain with lots of water unless the caution below applies.

CAUTION Salts of many heavy elements and their solutions should not be put into the sewage system. Here are some examples of such salts.

- barium chloride
- cobalt sulfate
- copper(II) chloride or sulfate
- iodine
- lead(II) nitrate
- mercury(II) chloride
- manganese(II) sulfate
- Nessler's solution
- potassium dichromate
- potassium permanganate
- potassium iodide
- sodium iodide

Collect these salts and their solutions in labeled containers. Dispose of these by burying them in places where they will not be disturbed.

Water-soluble, nonaqueous liquids (only small quantites — less than 50 ml — of low molecular-weight alcohols and acetone): Wash these down the drain with plenty of water.

Water-insoluble solids, broken glass, small pieces of metals: Collect these in labeled metal or crockery containers. Dispose of insoluble chemicals by burying them in a location where they will not be disturbed.

Flammable liquids: Store these in a labeled metal container that is UL approved, and dispose of them as directed by your local fire authorities. Except for small quantities that are water-soluble, don't ever pour flammable liquids down the drain.

If a solvent contains water-insoluble solids or solutes, never pour it into the drain, since a clogging precipitate may form. Collect such solutions and dispose of them by pouring them outside on the ground away from vegetation, heat, or fire.

More Sources for Safety Rules

In the space available, a complete and detailed list of all safe practices and precautions could not be presented. You should have available and be intimately familiar with one or more of the following references.

American Chemical Society. *Safety in Academic Chemistry Laboratories.* Washington, D.C.: American Chemical Society, 1975.

Fisher Scientific Co. *Fisher Safety Manual.* Pittsburgh: Fisher Scientific Co., 1974.

Manufacturing Chemists Association. *Chemical Safety Data Sheets.* Washington, D.C.: Manufacturing Chemists Association, various years.

Safety in the Science Laboratory. Tallahassee, Florida: Department of Education, 1968.

Corresponding publications should be available from your state department of education.

Steere, Norman V., ed. *Safety in the Chemistry Laboratory.* 3 vols. Easton, Pennsylvania: American Chemical Society, 1974.

Free and on-the-spot safety consultations with chemistry experts can usually be readily arranged by contacting the Safety Committee of your local section of the American Chemical Society. For further information, write to the Office of Local Section Activities, American Chemical Society, 1155 16th St., N.W., Washington, DC 20036.

Observing Safety

Here's one more safety note. Safety practices rarely can be promulgated by the teacher behind the desk, and, certainly, habitual safety consciousness never can be. Move around your classroom. Ask students, from time to time, "What are you doing? Why?" Students not only attend more to what they are doing when they know they are being observed, but they are more apt to be aware of the need to practice disciplined safety habits.

PART 4: CLASSROOM ORGANIZATION

Many different activities must go on in an ISIS classroom at one time. And materials must be stored in such a way that students can find and return them quickly. Careful planning must be done early to determine where things will be put and where activities will be carried out. Otherwise, students will be tripping over one another, and equipment could be lost or misplaced.

The first step in classroom planning is to consider the activities that must be carried on, the facilities you will need, and the kinds of items that must be stored. See Figure 4-1 below.

ACTIVITIES	FACILITIES NEEDED	STORAGE REQUIREMENTS
Doing lab work	flat lab tables or benches	accessible areas for lab equipment
Working with hazardous materials (see Part 3)	isolated lab area with safety provisions	special, secure area for hazardous items
Cleaning glassware and other equipment	sink, water supply, and draining counter	accessible areas for clean equipment
Reading and writing	any working surface near reference materials	accessible areas for booklets and resource units and other references
Listening to audiotapes Taking tests (see Part 7)	quiet area, probably near electrical outlet desk or table in quiet area	secure area for tapes and players secure area for tests

Figure 4-1

General Planning Procedures

Every classroom is a little different from the next. No matter what arrangement you have, you're going to have to organize things so that you can successfully manage ISIS. The following procedures can help you in your planning.

1. To save time and energy, sketch a plan of your room to scale. Figure 4-2 below shows such a sketch. Mark door and window locations, chalk and bulletin boards, sinks, and stockroom entry. If your tables are fixed, sketch them in as well. If your classroom furniture is movable, sketch several different arrangements to see the one best suited for ISIS activity and storage needs.

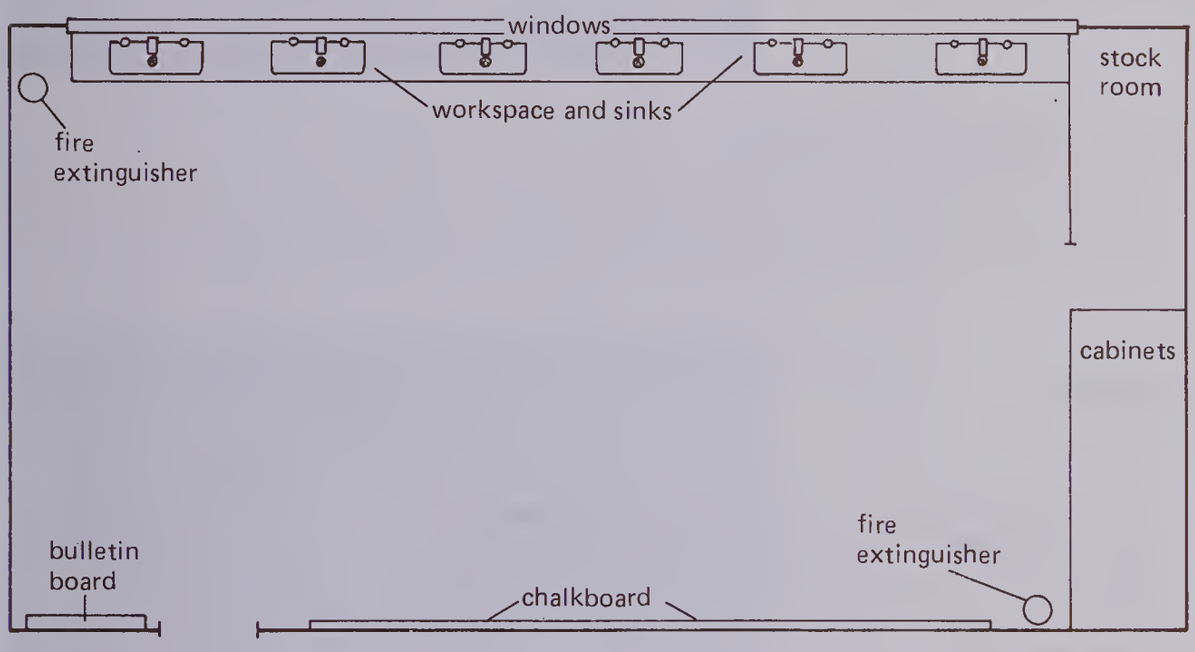


Figure 4-2

2. Decide whether you want to set up work areas according to minicourses or assign each student to a permanent place. (See Figure 4-3 below.) If work areas are set up by minicourse, the materials for that minicourse can be located in the area. That approach is appropriate only if you plan to have several minicourses under way at a time.

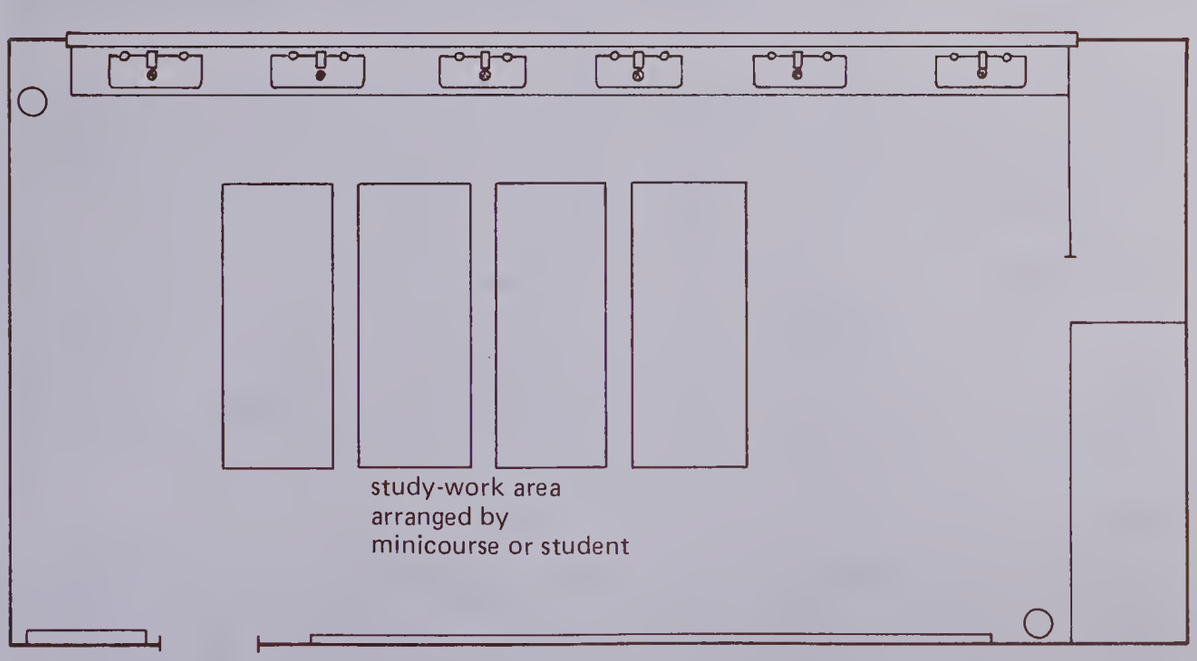


Figure 4-3

3. Decide whether you want to have one central work area for all activities except hazardous and testing activities or many work areas distributed in different sections of the room, as shown in Figure 4-4 below.

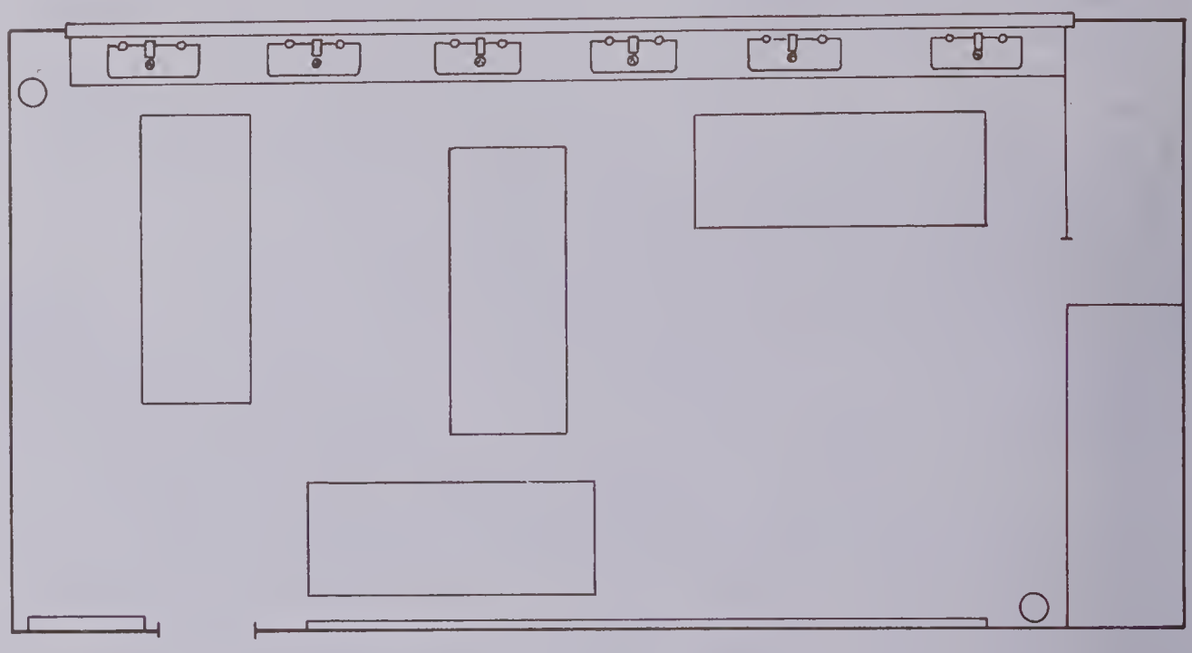


Figure 4-4

4. On your floor plan, identify the places in your room where the various work and storage areas will be. (See Figure 4-5 below.) Your design should facilitate smooth traffic flow from area to area, with special attention to reducing congestion in supply areas. Areas should be set aside for hazardous materials and for testing that are away from heavy traffic routes. Multiple pathways from work tables to supply areas can also reduce congestion.

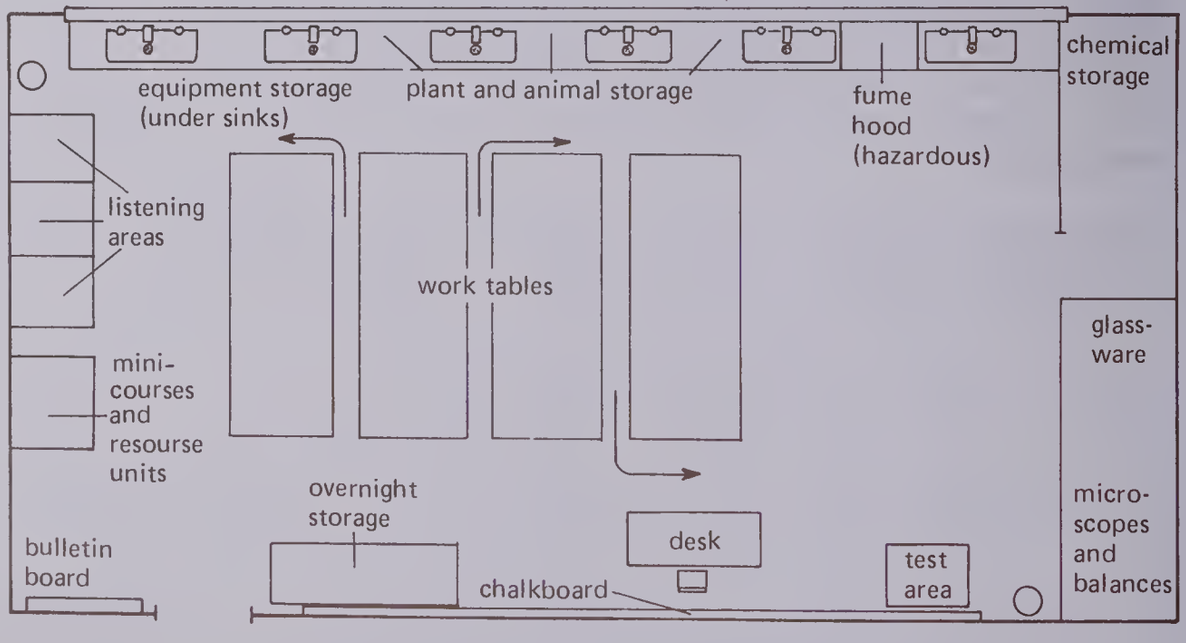
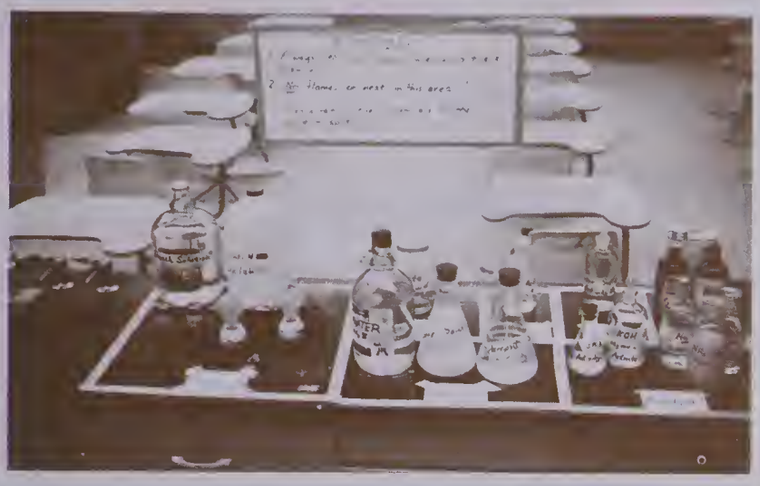


Figure 4-5

5. There should be clearly labeled places in the classroom where every item of equipment is picked up and returned. If the room is used only for your science classes, the locations can be permanently fixed. If other classes use the room or if you move from room to room during the day, the equipment sites may have to be portable (for example, on movable carts) or in locked cabinets when not in use.



6. When students are taking tests, it is important to provide them with a quiet area where they can concentrate. Set aside an area of the room away from the center of activity to be used for individual study and testing. The area might be sectioned off by bookcases or dividers. Or you might provide portable desk partitions with which the students can be surrounded at a particular table or at their own desk.

Planning for Using Shared Classrooms

Many teachers have to share and work in classrooms with other teachers. This arrangement creates special problems for ISIS teachers and requires special planning. Figure 4-6 below describes some of these problems and offers possible solutions.

PROBLEM	POSSIBLE SOLUTION
Room arrangement	Compromise with the other teachers with whom you share the room. Be sure to leave the room in the arrangement that you mutually decide upon.
Security	Be sure to remove or lock away all tapes, tape players, resource units, minicourse booklets, and equipment that are not to be shared with other classes.
Storage	Use lockable, well-labeled boxes, cabinets, or movable carts to store minicourses, equipment, and materials. (See Part 5 for details.)

Figure 4-6

Because there is much necessary setting up and putting away in a shared classroom, you'll probably want to use students to help you. Pages 30 through 32 of Part 5 suggest ways that students can become involved.

Planning for Using Multiple Classrooms

Some teachers move from classroom to classroom during the day. Such a situation should be avoided if at all possible. If you're forced to move from room to room, get a movable lab station like the one shown in Figure 4-7 below.

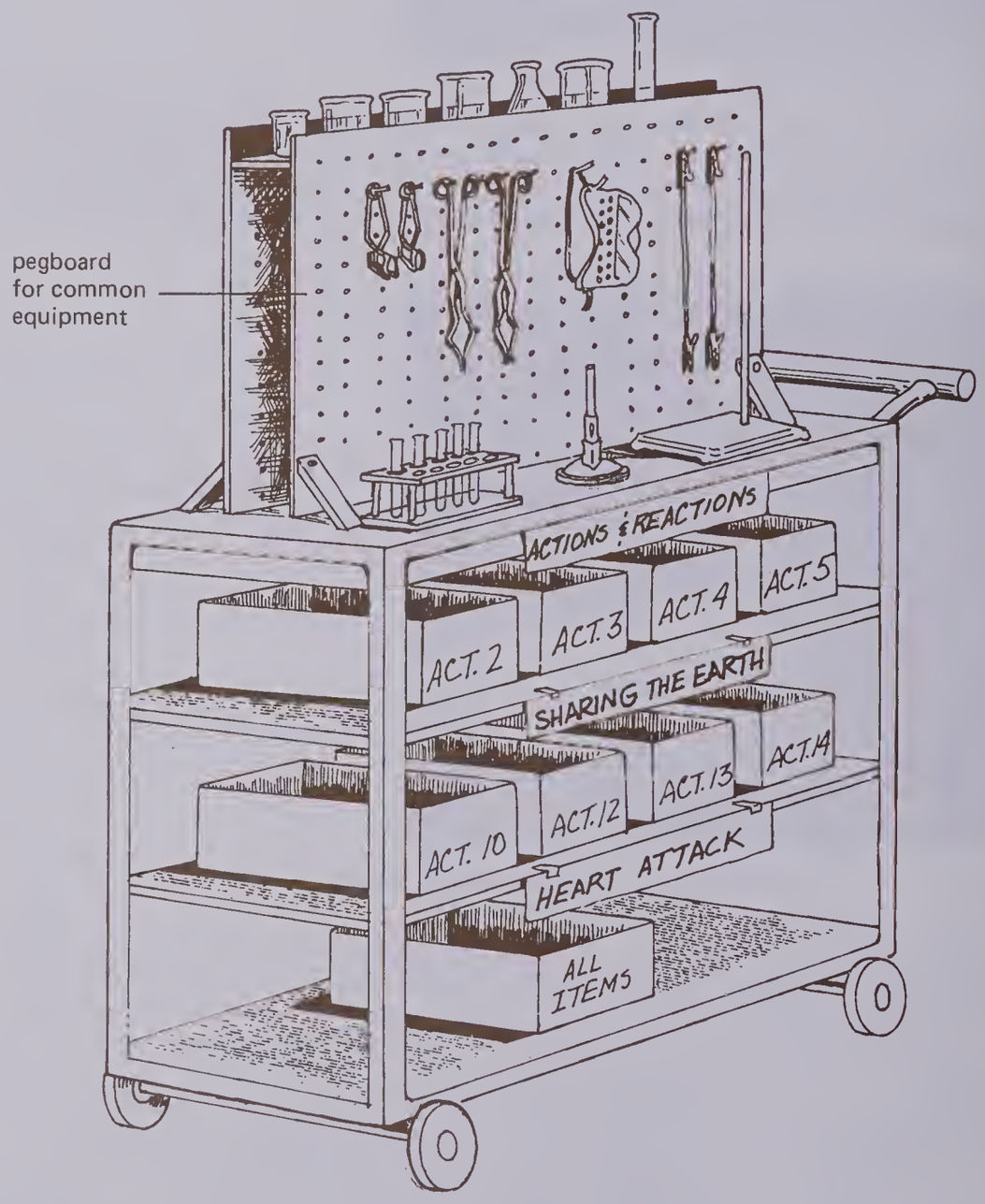


Figure 4-7

Include in the station the equipment items that are specific to the activities the students are doing that day. Shoe boxes labeled with an activity number are very useful for storing activity equipment. If two carts are needed to move all your equipment (including minicourses, resource units, glassware, tapes, tape players, and so on), have a student assistant or a class member be responsible for moving one of the carts to your next classroom.

PART 5: STORAGE AND RETRIEVAL

Whether you have your own room, share a room with other teachers, or use two or three different rooms during the day, you'll need a plan for storing and retrieving minicourse equipment and materials. Materials must be easily accessible to all students, easily returned, quickly inventoried, protected from damage and theft, and out of heavily traveled traffic lanes.

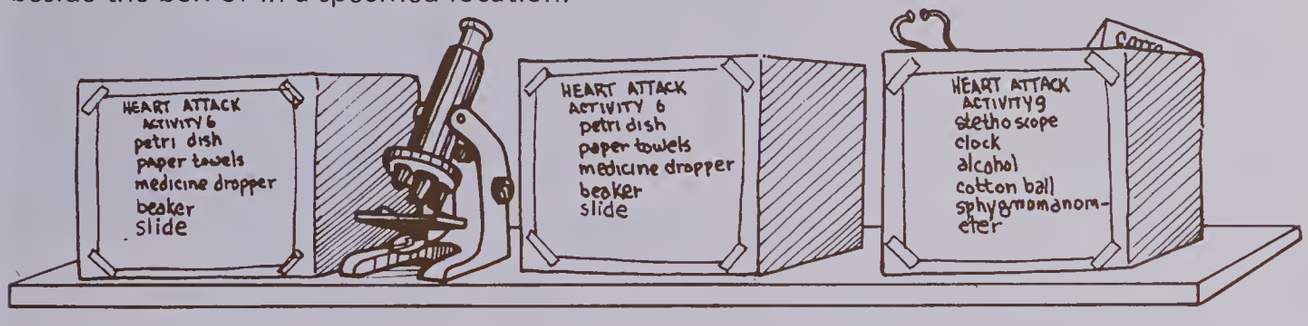
No matter what plan you choose to implement, you'll need to consider the following things.

1. How are you going to organize things so that you will be free to work individually with students?
2. How are you going to set up your room so that it is easy to keep clean and easy to inventory at the end of class?
3. How are you going to make equipment easily accessible to your students?
4. How are you going to set up the special areas of the room so that you can constantly monitor potentially hazardous activities, the use of tapes and tape players, and expensive equipment?

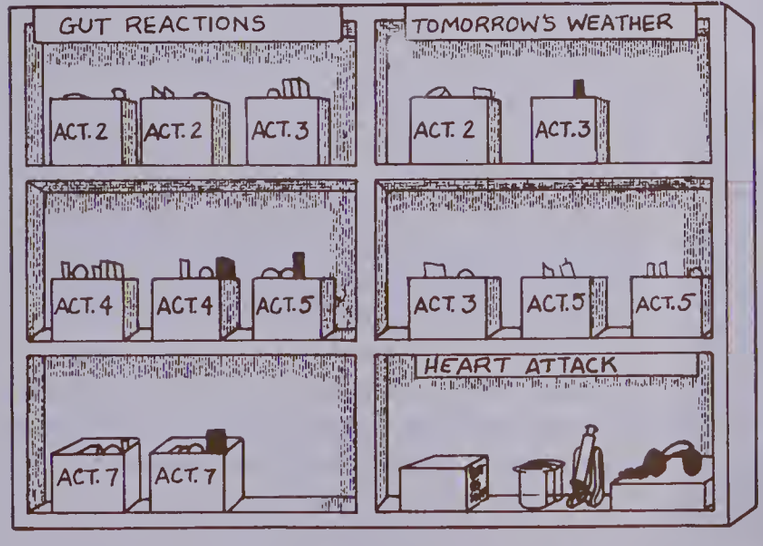
Some Organization Plans

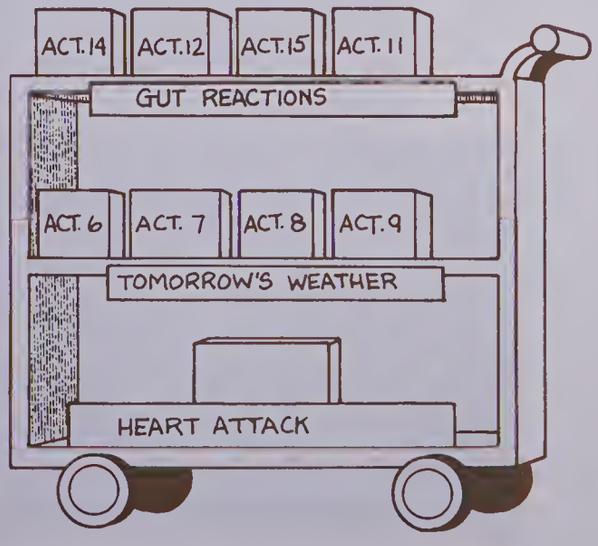
Some plans that ISIS teachers have found successful in different situations are suggested below. Choose the alternative or the combinations that best suit your classroom situation.

1. All equipment for each minicourse activity can be put into a well-labeled box. Shoe boxes are handy; plastic boxes are good for visibility; cardboard boxes are good for absorbency in draining glassware. Over-sized equipment can be placed beside the box or in a specified location.



Put the boxes on the particular shelf or cart that is labeled for that minicourse. You'll want to have enough activity boxes for students to work from. One or two boxes per activity should be adequate if three minicourses are going on simultaneously, but six or more boxes per activity may be needed if all of your students are working in one minicourse.





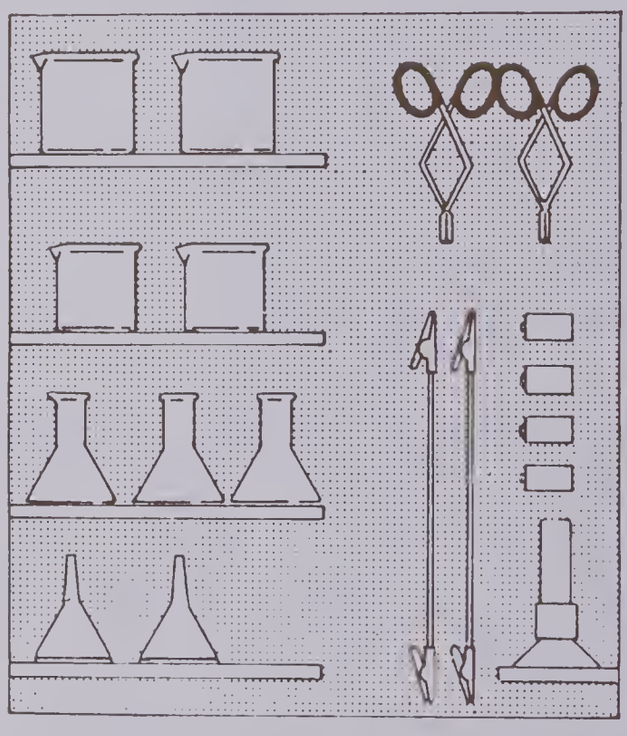
2. If storage space is available in the form of lab table drawers, you may want to label the drawers clearly with the minicourse title and activity number. An inventory list of each drawer's contents is a worthwhile addition.

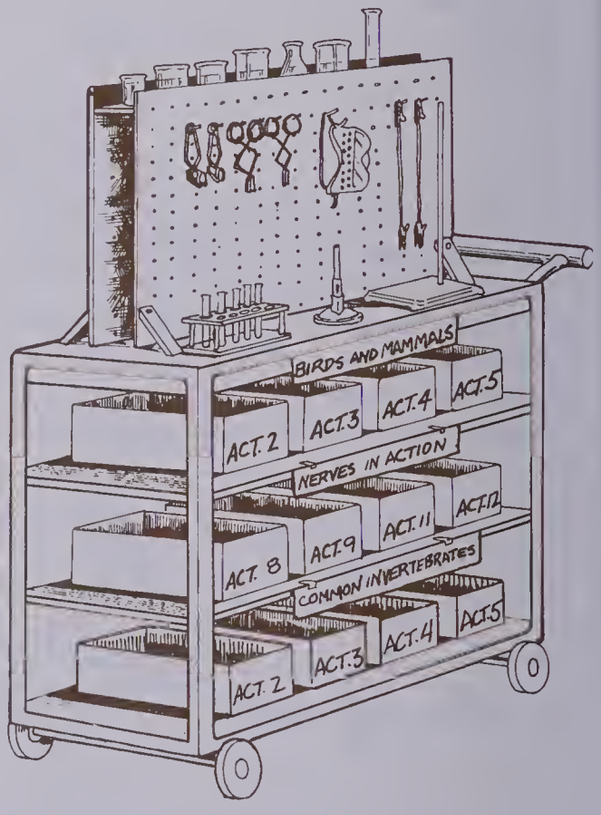
Another way to use a room with such storage space would be to equip each lab station with commonly used items and then display items particular to minicourse activities in well-labeled drawers or cabinet shelves around the room.

3. Equipment common to several minicourses, such as beakers, flasks, tongs, burners, and batteries, could be stored in a common area. You may need to have the students share many of these items when you don't have sufficient quantities to equip individual activity boxes.

A pegboard arrangement is effective for many items, such as tongs, funnels, and electrical leads. Hung this way, they permit fast and easy visual inventory — you can spot any missing items quickly.

If you move from classroom to classroom, the pegboard can be mounted on your cart, but be sure to attach glassware securely to prevent breakage.





4. You might choose to set aside a special area or lab bench for each particular minicourse. Students doing that minicourse would go to a specific color-coded area and use the equipment located there. All items for the same minicourse would be similarly color coded. This plan has many advantages, including that it is easy to spot items put in the wrong place or missing from the storage area. When one minicourse is no longer in use, you simply replace it with the equipment for another minicourse.

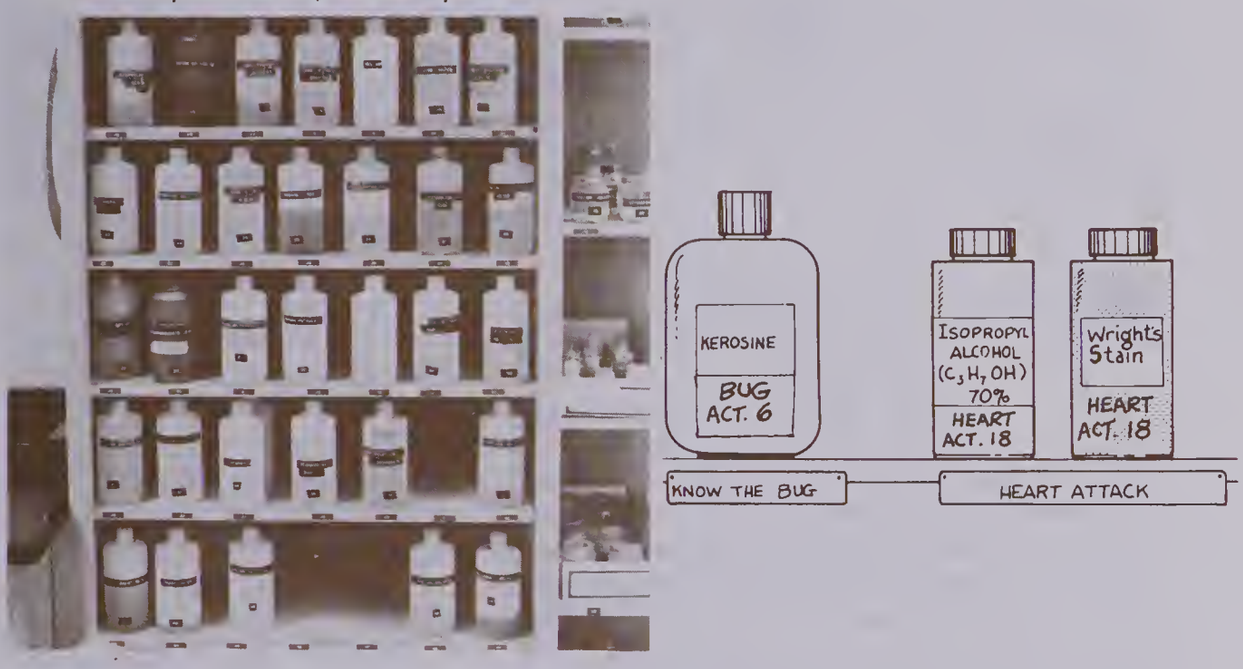
5. Tote trays can be used to store equipment. A student assistant could be responsible for checking them in and out each day. The advantage here is that a quick inventory is possible. Replacements are made when necessary. The tote trays can be stored in cabinets, on shelves, or in a storage room adjacent to the classroom. This system also provides security for equipment when other classes are using the room, especially if locks are used.

Special Storage Problems

Certain materials cause special storage problems for which you must plan. Some, such as certain chemicals, must be under your control. Others, such as balances, can be easily damaged.

Chemical Storage

Chemical reagents can be stored on shelves, in boxes, or in drawers. Be sure to label the bottles with the minicourse title and the activity number, the correct name of the reagent, and, where appropriate, the concentration. Whether stored on shelves or in boxes or drawers, dispense only limited amounts of chemicals at a time. This prevents large-scale contamination, discourages the use of excessive quantities, and controls the size of accidental spills. Hazardous chemicals should be stored in a special area, not in open boxes or drawers.



Storage of Easily Damaged Materials

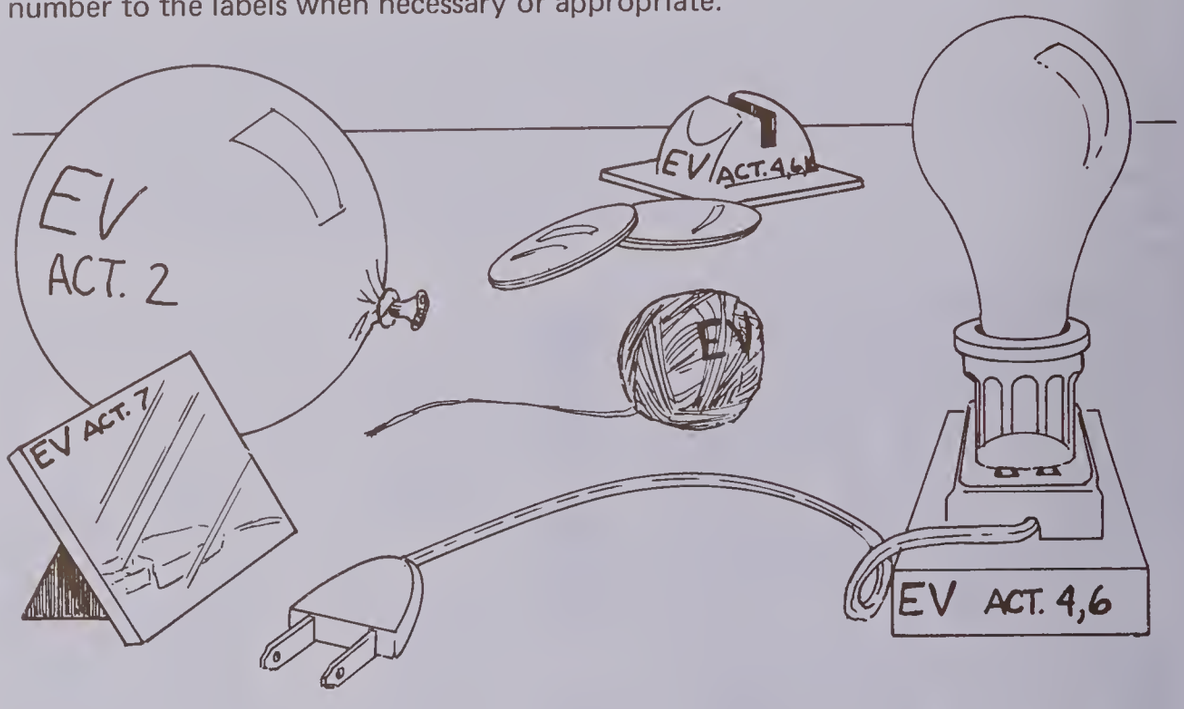
Certain types of equipment, frequently used, but not easily transported, must also have a special place in your classroom.

Balances last longer if they are not carted around. Microscopes should be kept in a closed storage area and preferably used in a special work area. Lens papers, slides, coverslips, gram weights, weighing paper, and other accessories for these pieces of equipment should be kept together in a special work area.

Labeling Equipment

Since much equipment and materials must be labeled, choose a labeling method and stick to it for all minicourses. Once the students understand your system, identification should go smoothly. Here are two suggestions for labeling methods.

You could assign code letters to each minicourse. You might, for example, assign the letters *EV* to *Eye and Vision*. Then, label everything related to that minicourse — games, equipment, tapes, charts — with the code letters. Add the activity number to the labels when necessary or appropriate.



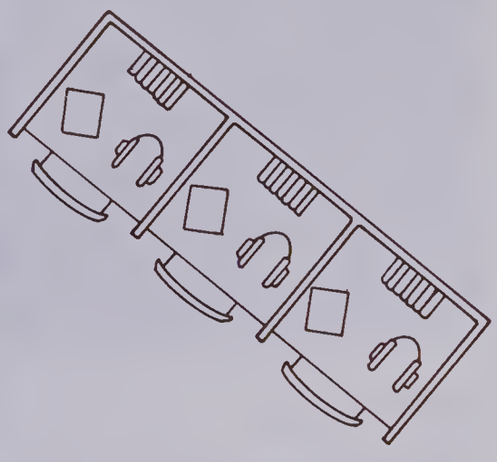
Each minicourse uses some form of identifying symbol throughout the book. This symbol can be used to help in identifying materials for that minicourse. Have an artistic student make copies of the symbol for use on all materials related to that minicourse. Figure 5-1 below shows some examples of minicourse symbols and the way they might be used.

Figure 5-1

Audiotapes and Players

Several minicourses have audiotape cassettes that are an integral part of the instruction. If possible, set aside an area of the classroom for using these tapes.

The tapes should be clearly labeled as to the minicourse and the activity in which they are used. The shipping boxes they arrive in make good storage bins that can be kept right in the listening area.



Tape and Player Security

Headsets or earpieces are a must for tapes. If theft is a problem in your school, some of the following suggestions may help increase security.

1. Chain or bolt down the tape players.
2. Use tape players — instruments that play tapes, but cannot record.
3. Use players plugged into alternating current (AC) rather than those operated on batteries. (AC adaptors are also high-risk items, since they fit many pocket calculators and radios.)
4. Have students check out tape players from you or an assistant.
5. Just before the end of each class period, do a quick visual inventory to make certain all tape players are accounted for.
6. If other classes use your room, lock the tape players in a cabinet when they're not in use. Students working with the materials who understand the importance of the tapes to the program are probably less likely to walk off with equipment than visitors in your classroom.

Listening Areas

You may not be able to have a special listening area. If that's the case, students could use the tapes at their own work stations. The tapes and the players can be checked out when needed, or the tapes can be kept with the rest of the equipment for that activity.

If your school has a library, language lab, or media lab that can accommodate your students' listening needs, you can store tapes there. Then, you can send individual students there when they are ready to use the tapes.

Your school may also have film loops and filmstrips relevant to some minicourses, and you may wish to have these available for viewing.

Printed Materials

Minicourses, resource units, and other reference materials will also need to be stored. For reasons of economy, many teachers choose to have room sets of the minicourse booklets.

The storage arrangement can be a bookcase or boxes on a windowsill or table. If you can find an old magazine display rack, it makes an ideal place to keep minicourse booklets. With such a rack, students can visibly locate the particular booklet they need.

Resource Units

Resource units come as a perforated booklet. You may choose to keep all sets intact in their binding, or you may want to separate some of the sets into individual units and house each in a well-labeled folder. Since the units are also three-hole punched, they may be stored in a binder.

Having some resource units in individual folders makes it easy to select a particular one for the student who asks you for assistance on a resource-unit topic. It also allows students to take one home, if they want or need to, without tying up an entire set.

Store the resource units in the same way you store minicourse booklets. If you use the magazine-rack approach, resource units and booklets can be stored together.

Other Reference Materials

Choose a special location in the room where other reference materials can be located. This area should be readily accessible and, if your room is large enough, include a few desks or a table and chairs for students to use.

Whether reference materials are used in a special area or back at a student's work space, insist that they be returned to their proper storage location so that other students can find them.

Students in Classroom Management

Involve your students in the entire classroom management plan as soon as you can. Get out of the equipment business yourself. It takes time away from the more vital things you'll want to be doing. Getting a system of student management operating efficiently takes planning and effort. Once it has been done and is functioning properly, students will do a better job of classroom management than you can, since there are more of them.

The first step in student invovlement happens when you give students the overall picture on Day 1. A careful explanation of the rationale for care in handling, using, and returning things in the classroom will get students started in the right direction. Then, if you can assign some specific individual responsibilities, you will help them along the way. A firm attitude after the first incident of a lost piece of equipment,

unreported breakage, or mess that has not been cleaned will reinforce your earlier statements.

Students can be responsible for seeing that all things are returned in proper shape. Don't forget to include the special areas, such as the listening area for audiotapes and players, the resource unit and reference area, the area for balances and microscopes, and so on. A student's quick report to you before the class is dismissed will often result in the recovery of a missing article.

Once students get out of the room, assessing blame for messes or missing articles is difficult. Activities, therefore, should be ended in sufficient time to get the checking and cleanup done before the bell rings. Five minutes should be enough.

Using Laboratory Assistants

Some ISIS teachers use student lab assistants for certain duties. As one ISIS teacher put it, "Train your student assistants to do much of the equipment manager's job, and that will free you to do your job — interacting with the students."

Lab assistants can prepare equipment and materials for activities, grade tests, type and reproduce handouts, distribute equipment during classes, arrange for field trips, films, or guest speakers, gather reference materials from the library, and check inventory and classroom cleanliness at the end of the period. Assistants can be selected from within a class or from other classes.

Good student assistants are hard to come by. The intellectual, motor, and experiential skills of most students may not always match your needs. But remember that whatever help you get that ultimately saves you time and allows you more time for students is a plus for their use.

If you use lab assistants, caution them not to do work for which the students are responsible. For example, lab assistants should remind students to clean up their messes, not clean up for them.

Classroom Assistants

If you intend to use student assistants from within each class, here are some suggestions.

1. Post a list of the two or three students each week who will check specified storage areas in the classroom during the last five minutes of the period.

2. Post a list of students who will check equipment in and out and replenish supplies for one day each month during the class period. Many students will like this kind of change in activity from time to time, and it will tend to deepen their personal involvement in classroom management. If you use this system, be sure students are not penalized in terms of the quantity of completed minicourse work. They should not be expected to make up the time not spent doing minicourse activities. In fact, some special credit might be given for their work.

Outside Assistants

If you intend to use student assistants from outside the class, here are some suggestions.

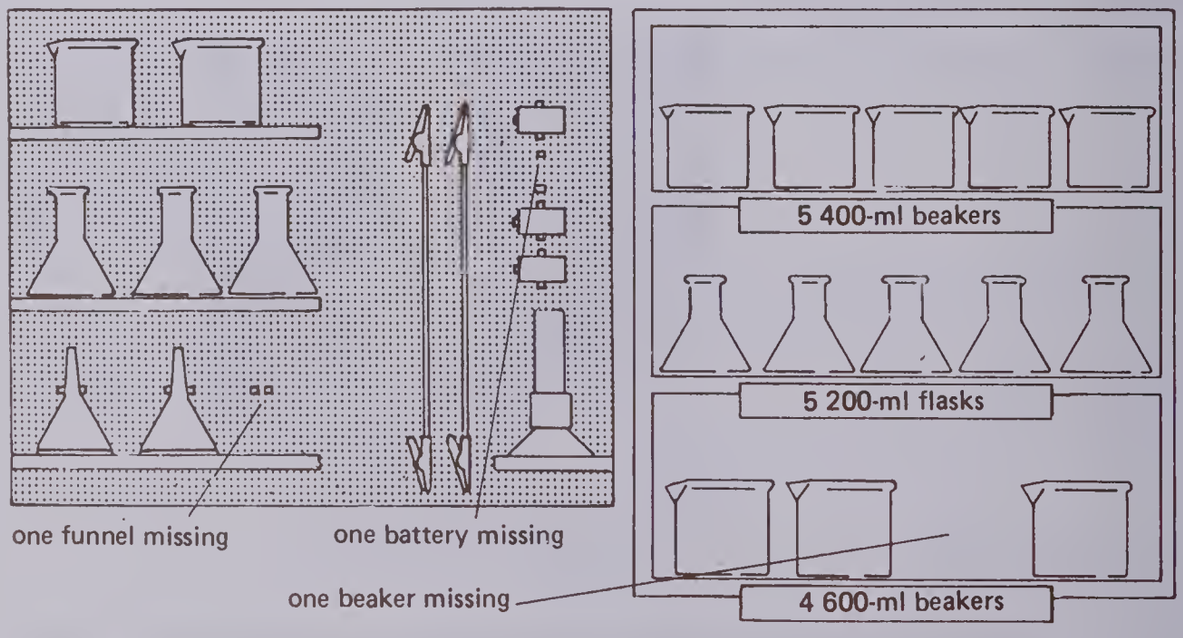
1. Work with the administrative staff of your school to construct a lab-assistant program that benefits both your program and the students' self-interest. The incentive system can involve money or credit. Avoid a totally volunteer system because you may not be able to rely on volunteer help when you need it.

2. Define for your lab assistants a definite schedule that they are to follow. If at all possible, arrange time after school so they can help you prepare for the next day. If possible, also have them available during some of your class period in order to free you from equipment management.

3. Have a definite list of directions for your lab assistant to follow when preparing materials and equipment for activities. The "Advance Preparations" in each annotated teacher's edition of a minicourse is written clearly and can be used in this way. Try to use your lab assistant to keep you at least one minicourse ahead of the class. You'll want to post a specific work schedule and define specific responsibilities for each lab assistant every week or so.

Security and Inventory

Security and inventory must be accounted for in your storage plan. The more visible your equipment storage is, the more easily it can be inventoried. When items are stored in boxes, lists or photos on the box will permit quick checks for missing items. If equipment is hanging on hooks or pegs, have exactly the right number of hooks or pegs. When all are full, you know that all equipment has been returned. If shelf sections are shallow, they can be arranged the same way.



Identify at the outset items needing additional security. Things like stopwatches, magnets, tape players, and small electrical motors fall into this category. A numbering and checkout system might help.

If other classes are using your classroom part of the day, you must find additional ways to secure your equipment and materials. If you have a closet, a storeroom, or drawers that can be locked, store all attractive items in such secure locations during the hours you are not in the room.

Untidy rooms seem to encourage stealing. If a room is untidy, it will be more difficult to notice that certain items are missing. Enforce cleanup time in your classroom.

PART 6: MONITORING STUDENTS' PROGRESS

Once your students are under way, you have the problem of keeping track of their progress and offering them help when needed. Figure 6-1 below simulates the progress of three students through the same minicourse. Examine the figure and notice the variations in the students' choices and work rates.

MINICOURSE SECTION	ACTIVITIES DONE		
	Student A	Student B	Student C
Core 1 (planning activity)	√	√	√
2		√	√
3			√
4	√	√	√
5	√	√	√
6	√	√	√
7			√
8	√	√	√
9	√	√	√
Adv. 10 (planning activity)	√	√	
11		√	
12	√		
13		√	
Exc. 14 (planning activity)	√		√
15	√		
16			√
17	√		
Days to complete minicourse	14	15	19

Figure 6-1

Using the core planning activity, Student A determined that he already could do some of the objectives and he was able to skip three core activities. Because of his interest in the subject, he did the planning activities for both the advanced and the excursion activities. As a result, he decided to do one advanced activity and two excursion activities in addition to the planning activities.

Student B was able to skip two core activities. Because she wanted to be prepared for college, she did the advanced planning activity and determined that she already could do one objective. She was able to skip the activity for that objective and do the other two. She could have done some excursion activities, too, but she decided not to.

The core planning activity convinced Student C that he could not do what was stated in any of the objectives. So he did all the core activities. After reading the excursion planning activity, he chose one excursion that interested him but, short on time, that was all he did.

Notice that the three students differed in the number of core activities they did, their choices about advanced and excursion activities, the total number of activities they completed, and the time they took to complete the minicourse.

All those facets of students' progress should be monitored. Here are some suggestions about ways you might monitor students who are working through different sequences at different rates.

1. Check the student's responses in his or her notebook to the activity questions he or she is working on. Look especially at the starred questions. Starred questions are especially important, since they are progress checks on the student's mastery of objectives. If you spot errors, orally quiz the student. If necessary, send the student back to parts of the minicourse that he or she does not understand. Write your initials on the page in the student's notebook that you spot checked so that there will be a reference point for the next check.

2. Date and stamp or initial each student's notebook daily. Ask your students to date each page as they do it or list starting and finishing dates for each activity.

You can also use a checklist such as that shown in Figure 6-2 below to keep track of the student's rate. Have the student copy the contents page from the minicourse and add the boxes as shown in Figure 6-2.

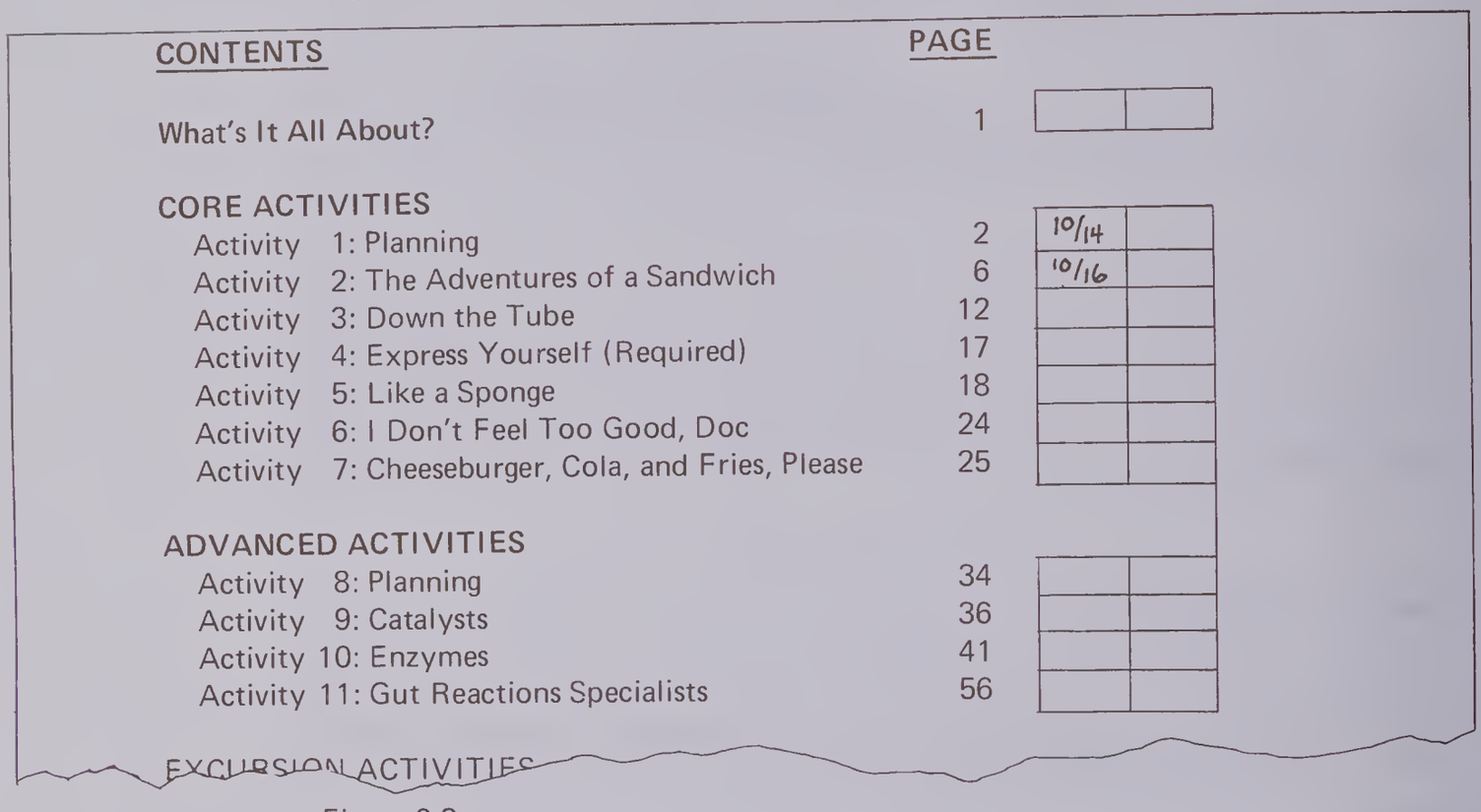

CONTENTS
PAGE
What's It All About? 1
CORE ACTIVITIES
Activity 1: Planning 2 10/14
Activity 2: The Adventures of a Sandwich 6 10/16
Activity 3: Down the Tube 12
Activity 4: Express Yourself (Required) 17
Activity 5: Like a Sponge 18
Activity 6: I Don't Feel Too Good, Doc 24
Activity 7: Cheeseburger, Cola, and Fries, Please 25
ADVANCED ACTIVITIES
Activity 8: Planning 34
Activity 9: Catalysts 36
Activity 10: Enzymes 41
Activity 11: Gut Reactions Specialists 56
EXCURSION ACTIVITIES

Figure 6-2

3. Be careful not to misuse data on rate and progress. Students should travel at different rates. Corrections are in order only for the student who is obviously moving too slow or too fast for his or her ability.

4. To assure students are working carefully and asking for help when they need it, you might tell them to be ready for informal questioning at any time on activities they have completed.

5. Informally checking laboratory skills is easy. Just observe students periodically in their regular work. Check for proper use of equipment, safe use of chemicals, and general progress.

6. Question students on the resource-unit skills or concepts required for an activity. Students lacking a skill covered by a resource unit should be directed to it. Students are often reluctant to leave their minicourse activity and use resource units, so you may have to encourage their use.

7. From time to time, call together a group of students who are working in the same minicourse and review their common problems and accomplishments. This provides a good vehicle for group interaction and also serves to review and illuminate important ideas in the minicourse.

8. Periodic checks (every several weeks) of large sections of a student's notebook can give you an overall view of the student's progress.

9. You might have students write a summary paragraph about the main points of the objective for each activity after the student has answered all of the questions and done the investigations in the activity. Check these paragraphs on a regular basis, and use them as one criterion for the evaluation of the student's work.

10. You might make up a two-or-three-question quiz for each activity, and have each student take the quiz in a few minutes after he or she has completed the activity. This will tell you whether the student has progressed satisfactorily through the activity. It will also prepare the student for the final test.

Accumulating Progress Information

Many teachers find it helpful to summarize information about students' progress in a single place. Figure 6-3 below shows one type of class progress record.

NAME	MINI-COURSE INITIALS	DATE CORE COMPLETED	CORE TEST Form A	CORE TEST Form B	ADVANCED OR EXCURSION ACTIVITIES COMPLETED	ADVANCED OR EXCURSION TEST Form A	ADVANCED OR EXCURSION TEST Form B	RESOURCE UNITS COMPLETED	MINI-COURSE COMPLETION DATE
BROWN, C.	EV	9/27	86%	—	8,9,10,11	74%	92%	9	10/4
DOE, J.	SC	9/28	90%	—	8,10,11	86%	—	11	10/6
LINSKY, R.	PS	9/25	65%	89%	17,18,20	92%	—	6,8	10/7

Figure 6-3

Instead of writing in the percentages scored on tests, you may prefer to write in the number of objectives each student masters. Your criterion for mastery of an objective might be something like two out of three correct answers on the test for each objective.

Figure 6-4 below shows a record card that can be used to summarize one student's progress.

STUDENT RECORD
Name _____
Minicourse Title _____

Core Activities Completed
Core test 1st try
2nd try
Excursion or Advanced Activities
No. _____
_____
_____
_____
Adv/Exc Test 1st try
2nd try

Date	Evaluation

Figure 6-4

Figure 6-5 below shows another way of monitoring the daily progress of students doing minicourses. The added feature here is the self-assessment by the student.

WORK AND EFFORT RECORD

Name _____

Date	Work Done	Effort: Very good	Good	Fair	Poor	Other

Figure 6-5

On this form, students can fill in the "Work Done" column each day and then rate themselves for effort. During cleanup, perhaps, you could go around the room and stamp the date. At the end of a grading period, the students could convert their effort scores to a grade and you could use the grade as part of your subjective considerations.

You may prefer to keep track of the students' progress through minicourses activity by activity. Figures 6-6 and 6-7 below show two methods of doing that. One method (Figure 6-6) utilizes a form filled in by students and kept in the teacher's file. The other method (Figure 6-7) utilizes a wall poster on which the student puts an *X* or the date when he or she has completed an activity.

STUDENT'S INDIVIDUAL PROGRESS RECORD

Name _____ Class _____

Minicourse Title _____

ACTIVITY NUMBER AND TITLE	DATE STARTED	DATE COMPLETED	SUMMARY OF ACTIVITY

Figure 6-6

CLASS PROGRESS CHART FOR *PLASTICS*

	Core Activities								Adv. Activities				Exc. Activities			
Section 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Azana, Jose																
Barron, Mary																
Blum, Sue																
Brown, James																

Figure 6-7

Figure 6-8 below shows a chart similar to the one illustrated in Figure 6-7, but in this case students are checked only at major points in their progress through a minicourse — core, advanced, excursion, and completion. It can be a wall chart displayed on the bulletin board in the classroom, and you or the students can enter the dates.

STUDENT		MINICOURSE											
		It's All Air				*Kitchen Chemistry*				*Water*			
		Core	Adv.	Exc.	Complete	Core	Adv.	Exc.	Complete	Core	Adv.	Exc.	Complete
ADAMS, PAT	START	9/12	9/21	X	X	9/30	10/13	X	X	10/20	11/2	11/8	X
	END	9/20	9/28	X	9/29	10/12	10/18	X	10/19	11/1	11/7	11/10	11/11
COHN, BOB	START	9/12	9/26	9/29	X	11/1	11/15	11/21	X	10/6	X	10/24	X
	END	9/23	9/28	10/4	10/5	11/14	11/18	11/23	11/24	10/21	X	10/28	10/31
FINO, DONNA	START	10/3	X	10/18	X	9/12	X	9/23	X	10/25	X	11/8	X
	END	10/17	X	10/21	10/24	9/22	X	9/28	9/30	11/7	X	11/16	11/17

Figure 6-8

No matter how you choose to monitor students' progress in your classroom, it is important to establish deadlines that each student must meet. This will keep most students moving along at a reasonable rate through each minicourse. In addition, it is helpful if you check each student's progress at least once a week, daily if possible. This too will keep them moving.

Decisions About Skipping

An important feature of the ISIS approach to instruction is that students may skip activities that cover core objectives they already can do. In addition, most students will omit some of the advanced or excursion activities included in a minicourse. It is important that the decisions made about skipping be intelligent decisions.

One ISIS goal is to develop students' independent decision-making ability, and the experience of skipping decisions is valuable in this regard. You can help students become better decision makers by teaching them how to make proper skipping decisions.

ISIS recommends that for at least the early minicourses, you discuss all decisions with each student after he or she has completed each planning activity. You can point out decisions that were properly made, those that were not, and the reasons behind your evaluation.

When students begin to show evidence of making proper decisions consistently, you might gradually relax your supervision if you choose. Or you might prefer to continue to monitor their decisions closely.

Here are some suggestions about making good skipping decisions.

1. Skipping core activities that cover familiar and understood content should be encouraged. It is particularly important for students who plan postsecondary education to skip familiar core activities. Doing so will give them more time for the advanced activities.

2. Encourage any student who is capable of and interested in doing the advanced activities to do all or part of them.

3. High achievers can often profit from doing excursion activities and should be encouraged to do so.

4. The advanced activities were designed specifically to prepare students for postsecondary education, especially college. Any student who definitely plans to enter postsecondary education should be made aware of this fact and be strongly urged to do advanced activities.

5. Students who do not do the advanced activities should not be made to feel less capable. Excursion activities should be considered to be different from advanced activities, not inferior to them.

Figure 6-9 below shows the ways three students made proper decisions about skipping or not skipping an activity.

SKIPPING CRITERIA	STUDENTS		
	Jane Feld	Althea Jones	Jay Yargo
Sample question for Objective X	answered question correctly	answered question correctly	answered question correctly
Starred questions in Activity X	answered two of the three questions correctly	answered all three questions correctly, except for one part of one question	answered two of the three questions correctly
Scanned Activity X	seemed to know some of the material in Activity X after a quick scan, but didn't understand the investigation	looked through activity and understood what it was about; also found answer to missed part of starred question	upon looking at activity, found answer to missed question, but wanted to do interesting investigation
Skipping Decision	don't skip	skip	don't skip

Figure 6-9

It is the ISIS position that if the student fails to answer the sample or starred question for the activity, the student should not skip that activity. But if the student can find his or her mistakes easily by scanning the activity, he or she might

decide to skip the activity. Skipping is never suggested when the student wishes to do some interesting investigation in the activity or if the topic itself has some inherent interest for the student.

Keeping Track of Skipping Decisions

Figure 6-10 below shows another form that can be useful in keeping track of each student's progress. This one aims particularly at skipping decisions. The form can be put on a file card and kept in a file box. It can be consulted when a discussion about progress or skipping is necessary.

NAME Martha DeVoe DATE BEGUN 10/14	MINICOURSE *Birds and Mammals* DATE COMPLETED
Core Activities I Need to Do	Date Completed
2	
3	
5 (know most; read only)	
8	
9	
10	
11	
Advanced Activities I Need to Do (decided after core)	Date Completed
Excursion Activities I Need to Do (decided after core)	Date Completed

Figure 6-10

The student (Figure 6-10), after doing the planning activity on October 14, had decided that she could skip Activities 4, 6, and 7 in the core. Thus, she listed all others. The dates at the right indicate when she completed Activities 2 and 3. She also indicated that she knew most of the objective for Activity 5 and could move through it fairly quickly, focusing on the part about which she was unsure. This information permits a quick review of the student's skipping decisions and also monitors the student's rate of progress through the minicourse.

A more complicated, but more complete form to help you keep track of students' skipping decisions is shown in Figure 6-11 (page 39). This form can be placed in each student's folder or in the student's notebook for quick reference by both you and the student.

NAME James Williams
DATE BEGUN 11/13

MINICOURSE *Changing World*
DATE COMPLETED

Directions: Circle the appropriate answer, and enter skipping decision in box.

Core Planning
Obj. 2-1
SQ—yes—(no)
*2-6—yes—(no)
*2-7—(yes)—no
*2-9—yes—(no)
Act. Scan—yes—(no)
Decision: no

Obj. 3-1
SQ—(yes)—no
*3-2—(yes)—no
*3-3—(yes)—no
Obj. 3-2
SQ—yes—(no)
*3-8—yes—(no)
Act. Scan—yes—(no)
Decision: no

Activity 4
(Required)

Obj. 5-1
SQ—(yes)—no
*5-3—(yes)—no
*5-4—(yes)—no
Act. Scan—(yes)—no
Decision: yes

Obj. 6-1
SQ—(yes)—no
*6-8—yes—(no)
*6-9—yes—(no)
*6-11—yes—(no)
Act. Scan—yes—(no)
Decision: no

Obj. 7-1
SQ—(yes)—no
*7-1—yes—(no)
*7-5—yes—(no)
Act. Scan
Decis

Obj. 8-1
SQ—yes—(no)
*8-1—yes—(no)
*8-4—yes—(no)
Obj. 8-2
SQ—yes—(no)
*8-11—yes—(no)
Act. Scan—yes—(no)
Decision: no

Advanced Planning
Obj. 10-1—yes
SQ—yes—no

Obj. 12-
SQ—y
*12

KEY	
Obj. 2-1	objective in planning activity
SQ	sample question in planning activity
*2-6	starred question in Activity 2

Figure 6-11

The student (Figure 6-11), after doing the core planning activity on November 13, had decided that he could skip Activity 5. He knows the reasons he must do the other activities. For Activities 2, 6, 7, and 8, he was unable to answer most of the questions (sample and starred). For Activity 3, he knew the content for Objective 3-1, but he didn't know it for Objective 3-2. In such a case, the student should do the activity, focusing on the part that deals directly with the content specified by the missed objective. The student must do Activity 4, of course, since it is required.

This information in Figure 6-11 is very useful when you sit down with your students to monitor their skipping decisions. You will know what they believe they understand in the activities, and you can spot check their knowledge based on their answers on the form.

PART 7: TESTING AND GRADING

The first day of class, your students will probably want to know all about your tests and your grading system. You'll need to be prepared to give them at least an overview of your testing and grading procedures.

No matter what testing and grading system you use, you'll probably want to consider both objective and subjective factors in the student's grade. Objective factors are those that you can easily quantify. Subjective factors in your grading system are usually less easily quantified, but they may be equally important to you in your total assessment of the student. Both types of factors are discussed in this part, and you can choose those that seem most appropriate to your local situation.

Administering Minicourse Tests

Each minicourse is accompanied by two forms of a short-answer test that samples the objectives stated in the planning activities in the minicourse. Each test form is divided into three parts. Two parts sample objectives from the core and the advanced section of the minicourse. The third part is based on the starred questions in the excursions.

Students should take the minicourse test in two parts — the core part and the advanced and excursion part. They should pass both parts to your satisfaction. Depending upon the individual student's selection of optional activities, he or she will fall into one of the testing patterns shown in Figure 7-1 below.

	FIRST PART	SECOND PART		
PATTERN	Take Core Test	Take Advanced Test	Take Excursion Test	Take Mixture of Advanced and Excursion Test
1	√	√		
2	√		√	
3	√			√

Figure 7-1

All testing materials should remain securely under your control. When a student has completed the core section of a minicourse, he or she should come to you and ask to be tested over the work. Later, the student should ask to be tested over the advanced and excursion activities that he or she has completed.

Testing Individually

Because ISIS students progress at different rates, they often must be tested one at a time. This calls for special techniques in administering tests.

You might want to use procedures similar to the following when you administer the core section of the test.

1. Make sure the student has a pencil, either Form A or Form B of the core test, and a printed answer sheet or a piece of paper for recording answers.
2. Record whether the student got Form A or Form B of the test, and be sure to give him or her only the core segment.
3. Have the student answer all core test questions on the form of the test being taken. For each question, the student should choose the one response that best answers the question or completes the statement. Caution students to be sure that their answer numbers correspond to the question numbers.
4. When the student has completed the core test, it should be immediately scored by you or an assistant. Answers are provided for your use.

5. Decide in advance on the performance level that you expect. If the student reaches that level, tell him or her to begin the next part of the minicourse. If the test score is below your standard, send the student back to the core activities indicated by missed test items. (You may want to give the student the numbers of the missed objectives.)

6. Be sure to collect the test forms and the answer sheets promptly when the test has been completed. (See the section below for suggestions on test security.)

7. Students returning for a retest of core activities should be given the form of the test that they did not see the first time. Further individual testing may be necessary if test performance remains below your standard. In this case, you might provide your own test questions or use the essay items provided in the ATEs.

When you administer the advanced and excursion part of the test, you might want to follow procedures similar to the following, in addition to the procedures listed for the core part of the test.

1. The student should have completed all the advanced and excursion activities that he or she planned to do before asking for this part of the test.

2. Students should answer only the test items that correspond to the advanced and excursion activities they have completed. (This includes skipped advanced activities. Students are encouraged to skip advanced activities if they feel they can do an objective, but they still must answer the questions about the content.)

Test Security

Because students usually take ISIS tests individually, security is a different kind of problem than in group testing situations. Here are some precautions that you might want to follow.

1. Be sure to collect all test forms and answer sheets immediately after the student completes a test.

2. Keep all students not taking tests away from the testing area whenever testing is in progress.

3. When they are not being used, lock up all minicourse tests and other test materials, including the students' graded answer sheets.

4. Visually check students taking tests as often as you can. Have your testing area located so that this is as easy as possible.

Additional Test Items

Many teachers like to administer test items on their own in addition to the ones built into the minicourse tests. In particular, they like to add essay items. ISIS encourages this practice, especially for minicourses that include objectives that begin with the verb *describe* or *explain*. Such objectives can be only partially measured using the objective-type items that must by necessity be used by ISIS.

If you choose to supplement the minicourse tests with additional items, you might consider some of the following suggestions.

1. Try to make each of your own items correspond as closely as possible to one of the objectives stated in one of the planning activities in the minicourse.

2. Essay items are included in the ATE for each minicourse. Use those if they are appropriate for what you want to measure. You might want to use the objectives themselves as essay items, choosing those you feel best assess the student's knowledge of the minicourse content.

3. Students lacking sufficient writing skills can be tested orally. This procedure is too time-consuming to be used with all students, but you might wish to use this method in particular cases.

4. Suggested laboratory performance items are also included in many ATEs. They can be used to assess manipulative skills.

5. Warn your students in advance that you may include additional items on their tests.

Periodic Quizzes

You may wish to give periodic quizzes to your students to assess their progress through a particular minicourse. These quizzes may be oral or written, daily or weekly, objective or essay type. The source of such quiz questions might be the planning page objectives or sample questions, the starred questions in the activities, the ATE essay questions, or teacher-made questions not found in the ISIS materials. It is suggested that the minicourse tests not be a direct source of such questions, since the tests have been developed primarily as a post-minicourse assessment tool.

Required-Activity Products

Some minicourses include required activities. Such activities lead the student to develop some type of product. No test items related to such activities are included on the minicourse test. Instead, the student's success is measured by the quality of his or her product. You will need to develop criteria for judging required-activity products for all minicourses that include required activities. Be sure the criteria are based on the main points of the activity. Try to avoid judgments based solely on the attractiveness of the product.

Other Factors in Grading

No matter what combination of various factors you use to determine students' grades, it is best to explain to your students the basis for any personal judgments you will make. Let them know exactly what parts of their work will be judged and the criteria you will use in assessing their work. Though necessarily subjective, these factors should not remain mysterious.

One factor you might consider is students' work habits. You might give each student a daily "effort" grade in his or her notebook. Or you might use a form such as the one in Figure 7-2 below on a regular basis, perhaps weekly.

Student's Name: _____ Date: _____

Directions: Circle (in pencil) the number on the scale that best describes your effort during the last week. I will circle (in red) the number on the scale that I think best describes your effort. Your effort score will be the combination of the two sets of ratings.

Distruptive	1	2	3	4	5	6	7	8	9	10	Helpful
Lazy	1	2	3	4	5	6	7	8	9	10	Energetic
Disinterested	1	2	3	4	5	6	7	8	9	10	Interested
Goalless	1	2	3	4	5	6	7	8	9	10	Goal-oriented
Inattentive	1	2	3	4	5	6	7	8	9	10	Attentive

Figure 7-2

You might also want to question students as you move among them during class. A few oral questions could be the basis for a daily grade. You might orally question a few different students each day, covering the whole class in a week.

You might want to give students extra credit for showing improvement in their daily work over a period of time. Reinforcement of positive efforts often increases productivity on the part of students.

Another factor you might consider is the student's notebook. Notebooks can be picked up weekly, at the end of a grading period, semester, or year and checked for accuracy and completeness. The grade can be put on the notebook when it is returned to the student.

Grading System

In the ISIS program, all matters of grading are left up to the individual teacher, including the criteria, the standards, and the relative weighting of factors. The suggestions that follow are aimed only at assisting you in this difficult task. In setting up your grading system, consider the following things.

1. A self-pacing student should not be penalized in the grading system for taking reasonable time to move at his or her best pace. However, there must be some mechanism for discouraging laziness and misuse of class time and encouraging efficient, effective learning.
2. Both the quality and the quantity of learning should be taken into account in the grading system.
3. An uncomplicated grading system is probably more effective, since it is more easily understood.
4. Use the same basic grading standards for all students.

Before deciding upon a specific grading procedure, you might want to read through the following plans and choose those parts that would best fit your local situation.

Plan 1

Determine the minimum number of minicourses that each student must complete in the grading period. For example, in a nine-week period you might require each student to complete three minicourses. Establish percentage scores for the core part of the minicourse test that will be your minimum scores for each letter grade. For example, you might set ninety percent as the minimum score for an A, eighty percent for a B, and seventy percent for a C. Use the score on the advanced and excursion part of the test, if the student takes that part, to adjust the score on the core test either upward or downward. Weight each of the following factors, and determine the student's grade.

1. Number of minicourses completed
2. Score on the core part of the test with a possible adjustment from the score on advanced and excursion part of the test
3. Other factors

Plan 2

Assign each student a C upon completion of the core at some specified test achievement level, such as seventy percent. Then, the results of tests on advanced or excursion activities, again at a specified level of performance, can be used along with subjective factors to adjust the grade upward or downward. Figure 7-3 (page 44) illustrates that system, using specific percentages, which you can change.

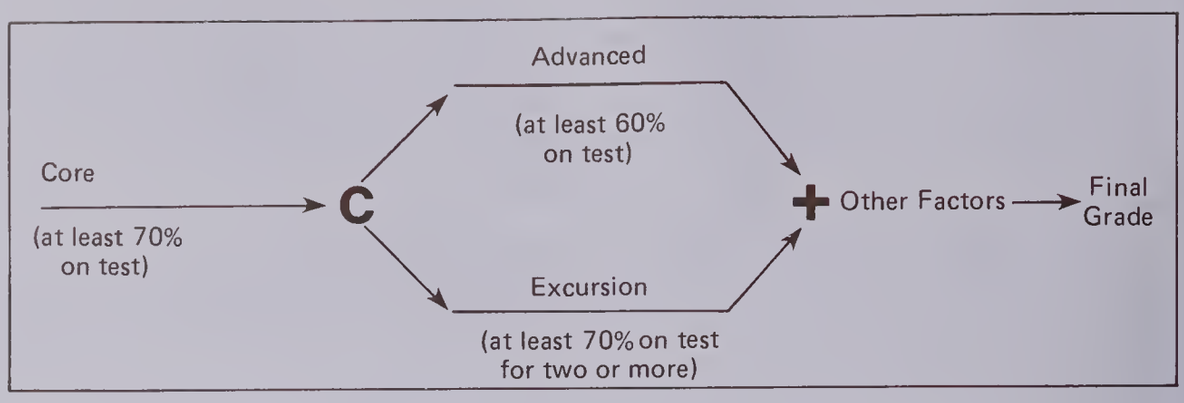


Figure 7-3

Plan 3

A grading system that considers both the quantity and the quality of work is shown in Figure 7-4 below.

AVERAGE TEST SCORE (in percentages)	NUMBER OF MINICOURSES (weighted)			
	One Minicourse (-2)	Two Minicourses (-1)	Three Minicourses (0)	Four Minicourses (+1)
60 to 64	F	F	D	C
65 to 69	F	F	D	C
70 to 74	F	D	C	B
75 to 79	F	D	C	B
80 to 84	D	C	B	A
85 to 89	D	C	B	A
90 to 94	C	B	A	A
95 to 99	C	B	A	A

Figure 7-4

In that system, the students are encouraged to work as fast as they can, but not too fast to reduce the quality of their work. Three minicourses in nine weeks is the optimal number. If fewer are done, the quality of the student's work must be higher for the student to receive a satisfactory grade. If more minicourses are done, the quality of work can be slightly lower and the student can still receive a satisfactory grade.

Plan 4

This plan uses a point system to consider all the factors involved in a student's grade. Figure 7-5 below shows the point distribution.

Each Minicourse: 10 Points Possible 3 points core test 3 points advanced and excursion test 4 points other factors 10 points total	Minicourse Test 90 to 100% = 3 points 80 to 89% = 2 points 70 to 79% = 1 point Grades A = 26 to 30 points B = 21 to 25 points C = 16 to 20 points

Figure 7-5

Figure 7-6 below shows how this system might be used to arrive at grades for three different students.

MINICOURSE	STUDENT A	B	C
Ways We Learn	6	8	9
Nerves in Action	7	9	8
Heart Attack	6	10	–
Know the Bug	5	–	–
Total points	24	27	17
Grade	B	A	C

Figure 7-6

Both quality and quantity are considered in this system. Again, three minicourses in nine weeks are optimal, but working harder on fewer minicourses or working faster on more minicourses can benefit students. Look specifically at the way Student A might have points distributed for those four minicourses (Figure 7-7 below).

	WWL	*NA*	*HA*	*KB*	
Core test	1	2	2	2	Total points = 24
Advanced and excursion test	2	2	2	1	Grade = B
Other factors	3	3	2	2	
Points	6	7	6	5	

Figure 7-7

Figure 7-8 below shows the point distribution for Student B, who did only three minicourses but displayed an extremely high quality of work.

	WWL	*NA*	*HA*	
Core test	2	3	3	Total points = 27
Advanced and excursion test	3	2	3	Grade = A
Other factors	3	4	4	
Points	8	9	10	

Figure 7-8

Plan 5

In the first four grading plans, the "other factors" were not well defined. The point system shown in Figure 7-9 below gives weight to many specific factors.

Each Minicourse: 100 Points Possible	50 Points for Other Factors
50 Points for Minicourse Test and Related Items	15 Notebook
15 Core Test	15 Work Habits
15 Advanced and Excursion Test	10 Improvement in Effort
10 Essay Questions	10 Oral Questioning
5 Lab Performance Items	50 Total Points
5 Required Activity (Project) or Extra Credit Work	
50 Total Points	

Figure 7-9

Figure 7-10 below shows how one student received a grade of C for the nine weeks. The student completed three minicourses (MC) during that time period.

Each Minicourse: 100 Points

FACTOR	MC 1		MC 2		MC 3	
	Points	Ratio	Points	Ratio	Points	Ratio
Core test (45 questions)	9	27/45	12	36/45	9.5	29/45
Adv. and exc. test (10/10 questions)	10.5	7/10	12	8/10	9	6/10
Essay questions (4 questions)	7	14/20	5	10/20	6	12/20
Lab performance (2 questions)	2.5	5/10	3	6/10	2.5	5/10
Required act. or extra credit	3	3/5*	4	4/5	4	4/5*
Points	32		36		31	= 99

*No required activity included in minicourse

FACTOR	MC 1	MC 2	MC 3
Notebook	11	13	10
Work habits	12	14	10
Improvement in effort	6	8	6
Oral questioning	7	9	7
Points	36	44	33 = 133
Points for Minicourse	68	80	64
Grade for Minicourse	D +	B –	D

A = 270 to 300 points 90 to 100% B = 240 to 269 points 80 to 89% C = 210 to 239 points 70 to 79%

Total points = 212 Final grade = C

Figure 7-10

Contractual Agreements

A contract is one way to make goals and requirements explicit for all students. The contract is simply an agreement between you and the student as to what you expect for a particular grade. The contract may be the same for all students or some parts of it may be negotiable for an individual need. Figure 7-11 below shows one possible type of contract.

NINE-WEEK ISIS CONTRACT

Student Carlos Melendez Date 1/25/78

I choose to contract for a(an) B grade. I will complete 3 minicourses and will strive to achieve a score of 240/300 or better. The minicourses I will work on are checked below.

(✓) *Packaging Passengers*
( ) *Things That Repeat*
(✓) *Know Your Car*
(✓) *Physics of Sport*
( ) *Eye and Vision*

Signed Carlos J. Melendez
Student

Mrs. Anita Melendez
Parent

Figure 7-11

Interesting options should be available for students who finish their contracts early. Parents should understand when signing the contract that students will have earned this nonscheduled time. Students can be encouraged to work on science-related activities and not waste time. Such activities might include being a student assistant, reading science fiction, setting up a special display, or doing some in-depth research on a minicourse topic.

Figure 7-12 below shows another type of contract. Since it covers the entire year, it provides the option of renegotiations.

CONTRACT FOR ISIS MINICOURSES
(Minimum: 12 minicourses)

Date: Sept. 26, 1977

I, Peggy Zaleski, will complete 12 ISIS minicourses for 2 credits toward fulfilling the science and graduation requirements.

This contract can be renegotiated after one calendar month or more if this is desired by either person who signs.

Signed Peggy Zaleski Date Sept. 26, 1977
Student

Mrs. Williams Date Sept. 27, 1977
Instructor

Note: You may want to plan to complete more than 12 minicourses by the end of the year.

INFORMAL RECORD OF MINICOURSES

Minicourse	Completion	
	Target Date	Date Achieved
1. *Getting Enough Oxygen*	Sept. 27, 1977	Sept. 23, 1977
2. *Nerves in Action*	Oct. 18, 1977	Oct. 14, 1977
3. *Keeping Fit*	Nov. 8, 1977	Oct. 31, 1977
4. *Gut Reactions*	Nov. 11, 1977	
5. *Perception*	Nov. 30, 1977	
6. *Snakes and Other Critters*	Jan. 6, 1978	

Figure 7-12

Note that the student (Figure 7-12) allotted nine full weeks for the completion of her first three minicourses. But after about eight weeks, she found that she needed only about two and a half weeks per minicourse. So she renegotiated her contract with her teacher to reflect that. In her new contract, she may have chosen to do two or three extra minicourses or she may have chosen to earn extra credit by doing a special project.

Allowing For Special Needs

You may want to adjust minimum acceptable test scores and the number of minicourses according to the abilities of individual students. For example, a poor reader might not be required to complete as many minicourses or as many optional activities as a good reader. The low-ability student might be given a lower acceptable minimum test score as well. Figure 7-13 (page 48) illustrates some adjustments that might be made.

ADJUSTED FACTORS	POOR READER	LOW-ABILITY STUDENT
Number of minicourses required in nine weeks	2	3
Number of excursions required per minicourse	1	2
Minimum acceptable test score	80%	70%

Figure 7-13

College Preparation Standards

One of the real pressures on high school science teachers is to see that students who plan postsecondary education are qualified for admission and are prepared to do the work. You may want to make special adjustments in order to cope with this problem.

You may find that your science class contains four different categories of students — those who plan no further education, those who plan technical careers, those who plan to go to college but major in a field other than science, and those who plan to go to college and major in science.

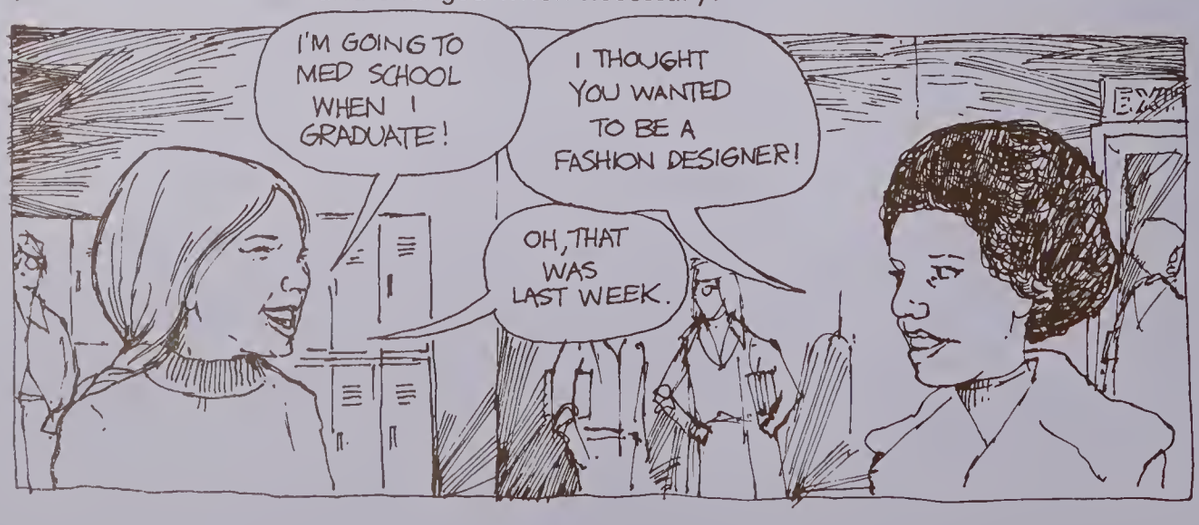
The ISIS program is not designed for students who plan to major in science in college. Try to have such students moved to another course or offer them another course within your classroom. If those options are impossible, insist that they complete more minicourses and do all advanced activities.

The other three kinds of students may be given different sets of requirements to fit their future plans. Figure 7-14 below shows one way to adjust requirements. Keep in mind that the entries are examples only, and you will likely want to adjust them.

REQUIREMENTS	STUDENTS		
	Technical Career	College Bound	Terminal
Number of minicourses in nine weeks	3	4	3
Number of advanced activities per minicourse	all	all	optional
Number of excursion activities per minicourse	optional	optional	2

Figure 7-14

If you choose to have college preparatory standards, you have the problem of identifying the students who fall into this college preparatory category. Keep in mind that many high school students don't know what they plan to do after high school. Such students should not be forced into a hasty and final decision just to fit a pattern. You'll probably want to set up mechanisms whereby a student's plans can be reviewed and changed when necessary.



Whatever procedure you use, it's wise for you to be sure the student's parent or guardian is aware of the student's decision. A form such as the one in Figure 7-15 below might be prepared and sent to the parent or guardian.

Name of School _____
Grade _____
Date _____

_____ has indicated that he/she
(student's name)

☐ plans to attend college or enter a technical career after high school

☐ does not plan to attend college or enter a technical career after high school

and is pursuing science activities geared to that goal.

Should you wish to discuss this choice with me, please indicate this below, along with your phone number, and I shall call you.

☐ I wish to discuss _____ choice.
(student's name)
My phone number is _____.

☐ I think this is an appropriate choice for _____.
(student's name)

_____
(signature of parent or guardian)

Figure 7-15

If attitudes and policies in your school and community towards accommodating students' individual differences are such that different requirements for different students within the same class are unacceptable, you might consider offering two different ISIS courses in the same classroom at the same time. Course designations such as those shown in Figure 7-16 below are appropriate.

COURSE DESIGNATION	REQUIRED WORK
Science: ISIS College Preparatory	Core + advanced activities
Science: ISIS General Education	Core + excursion activities

Figure 7-16

Such a designation could be used on report cards and school records to indicate differences in each student's achievement.

If such a procedure is used, be sure that your system is clear at the beginning of the year to students, school officials, and parents. Explain the way decisions are made as to which course each student takes, and delineate the requirements and criteria for evaluation in each case. Everyone must realize that within the same class students working side by side are being required to do different kinds of work and are being evaluated differently.

PART 8: OPTIMIZING LEARNING

An assortment of miscellaneous items, which have no appropriate place in other parts of this booklet, are dealt with here. Several of them are not first-week concerns, and your decisions about them can be postponed at least briefly. You might want to read through this part quickly and consider those sections immediately that you feel need early attention.

The ISIS Student

ISIS is not designed for all students. Specifically, it is not recommended for students who plan to enter a science-related job or who plan to major in science at a college or university. Such students are better served by the more rigorously quantitative and abstract courses offered in most high schools.

ISIS is designed for any student who is not likely to specialize in science upon high school graduation. It should be noted that most high school students fall into that category and the category includes most students who ultimately plan to enter a college or university. ISIS assumes that potential English majors, music majors, history majors, business majors, and so on will all be better served by doing ISIS minicourses with their focus on applied science rather than by struggling with the abstractions that are featured in conventional science courses.

Before implementing ISIS, you might want to communicate with the person responsible for the class scheduling for your school. Describe for that person the type of student who should be in your ISIS science courses and help him or her to establish criteria for ISIS students and for students for your other science class. Then work out procedures for transferring misplaced students once classes begin.

The ISIS Approach

The ISIS approach to instruction is actually quite simple. All you as a teacher have to do is to arrange your equipment in some manner to make it readily available. Then distribute the students' materials, and tell your students to go to work. Next help individuals and groups of individuals when help is needed.

But perhaps you, like many teachers, feel that this approach is just too simple to work. Perhaps you feel that you must assume a more directive role in the classroom than the ISIS approach suggests. Experience has shown that exerting such control is a detriment to successful implementation of the ISIS program. If you are considering this, ISIS urges you to reconsider.

Two fundamental concerns seem to be at the heart of most teachers' reluctance to give the ISIS system the chance to prove itself. Some teachers feel that students are simply not mature enough to assume the kind of responsibilities that the ISIS program assigns to them. Others feel that they would not really be teaching if they were to give the students more responsibility in determining the pace and scope and sequence of what they learn.

The concern that high school students are too immature to assume more responsibility for what goes on in the classroom is simply not supported by what has been observed during the experimental years of the program. More than 40,000 students of all types from all parts of the country demonstrated convincingly that they could assume such responsibility if their teacher gave them the opportunity to do so. If you are concerned about the maturity of your students, ISIS urges you not to allow this concern to deter you from giving the program a chance to work. If you give them the chance, your students will probably surprise you with their diligence, honesty, and ability to govern their own affairs.

If you are concerned that giving students greater responsibility means that you won't really be teaching, you are misjudging what students do under these circumstances and what the ISIS program is designed to do. Most teachers soon conclude that they can do more and better teaching under these circumstances than ever before. They usually find that they are soon dealing with a constant stream of questions to which the students really want answers. Furthermore, they find that the questions really go to the heart of the subject matter called *science*. More important, they find that because they are freed from mechanical duties, such as demonstrating how to set up equipment, telling students what equipment is required, and the like, they have more time to interact with students on more important matters. Many teachers have felt that ISIS gave them their first opportunity to do real teaching.

The nature of the materials is such that students can theoretically learn everything in them for themselves. In reality, however, this is neither possible nor desirable. Although your role as a teacher is likely to be somewhat different than it has been in the past, it is nonetheless a critical role. As a matter of fact, one of the primary reasons for developing the materials along their present lines is to enable you to function more effectively by allowing you to concentrate your efforts where they are needed most.

The ISIS approach stems largely from a mistrust of the conventional plan of science teaching — a teacher working simultaneously for thirty or more students. ISIS feels that the group approach to education wastes time and talent because it incorrectly assumes that all students need the same kind and the same amount of help in learning what has been specified.

You have probably recognized that, given a proper description of what is to be learned and appropriate clues as to how to proceed, some of your students can operate effectively with little or no assistance. For such individuals, your lectures and discussions may even get in the way and actually represent an educational disservice. On the other hand, most of your students require considerable help. Moreover, each student requires his or her own particular kind of help.

The ISIS program provides your students with the "storylines" for the course, along with directions in the use of equipment and other procedures. Therefore, it frees you to work with individual students as they encounter specific difficulties. Most teachers who have used the program have found that this dramatically increases the relevance of their teaching.

The ISIS Classroom

Within certain limits, the students in ISIS classes are their own bosses and have greater freedom than those in more traditional approaches. But that does not mean they are free to do anything they wish. Activity must remain purposeful. Your actions as a teacher will determine the degree to which this is the case. The trick is to be firm at the right time. The next few paragraphs will help you decide what the "right time" is.

The ISIS class atmosphere should be informal. In activity-centered programs a certain amount of noise will occur. Noise from the manipulation of the equipment and from normal conversation is to be expected and is desirable. If the noise level seems to be objectionable, analyze the sources of sound. Are the students discussing their work? Are they speaking in conversational tones? Is the equipment being correctly manipulated? If the answer to these questions is yes, stop worrying! If the answer is no, identify the misbehaver and let him or her know that others are being disturbed. Students are generally cooperative if they are approached in this fashion. They usually accept the fact that more freedom means increased responsibility.

Since ISIS students travel at their own speed, some may drag their feet, whereas others may cover as much territory as possible with little care for thought or accuracy. The foot draggers will need encouragement, but the speedsters present the more serious problem because they are more apt to make errors and misunderstand the work. Try to identify speedsters as early as possible. The longer their work goes unchecked, the more difficult it becomes to correct their bad habits.

At times, minicourse activities call for students to work in pairs or larger groups. In these situations, it is a good idea to allow students to choose their own partners. However, if certain combinations of students spend their time socializing, question them about this. If they persist, you may have to separate them.

Students must respect the rights of others as they use the equipment. Equipment that is in great demand should be used quickly and then returned for use by others. Equipment that is missing or tied up too long can cause serious delays or prevent students from doing some activities. In situations in which several science classes share the same equipment, each student must accept a share of the responsibility for keeping the classroom neat and clean. No student should have to face a room left in a mess by a previous class or classmate.

The student who abuses equipment, disturbs others, or shows too little interest in doing work needs to be dealt with immediately. Such students must be made aware that in abusing their privileges they are interfering with the rights of others and this cannot be permitted.

The Art of Questioning

During the school year, your students will be asked to answer several hundred questions that arise from the activities they do. Getting students to answer these questions is the heart of the ISIS program. In coming up with answers, students are forced to focus upon the important implications of the activities. The way that you interact with your students will determine to a large extent whether or not the questions that are posed will accomplish the ends for which they are intended.

Your students are not likely to adjust instantly or automatically to the process of solving problems for themselves. As they encounter difficulties, they are likely to turn to you for answers. Although ISIS hopes you will provide them with the necessary assistance in finding the answers, try not to give the answers to your students. It is in this area that your skill as a teacher will perhaps receive its greatest challenge.

Since the ISIS course is designed to help students find answers, the best way to respond to questions from the students is with questions. Skillfully phrased questions can lead students to focus upon what is preventing them from progressing and thus help them to eliminate the block themselves. For example, suppose that one of your students had done an investigation and has collected data that he or she cannot interpret. It is obvious to you that the student has used a piece of equipment incorrectly. In such a situation, it would be better to ask, "Have you checked to see that your equipment is set up properly?" or "What are the things that could possibly have gone wrong with your investigation?" than it would be for you to say, "Look, you tied the string to the wrong side."

Keep in mind that giving students practice in finding answers for themselves is fully as important as the answers.

Inexperienced ISIS teachers are sometimes frustrated by the flow of questions that occurs early in the year. They sometimes find themselves virtually swamped by students requesting help. To stop this problem, stay on the move and avoid being cornered. Experience has shown that students are less likely to ask superfluous questions if the teacher is on the other side of the room. And a large group of students surrounding a teacher seems to act as a magnet to other students who have trivial questions.

If the questions asked early in the school year are handled properly, your problems later will be minimized. If students learn early that you refuse to be a crutch for answering questions with obvious answers, they will soon stop asking such questions. One way to instill this idea is to refuse from the outset to answer any question that the students themselves should be able to answer.

To make the best use of your limited time, you might want to work with the students with easy problems first and tell those with more difficult ones to work on some other activity until you can get to them. That way you will have a minimum number of students standing around waiting for answers.

Transfer Students

One of the real advantages of ISIS is the ease with which transfer students can be admitted to the program. Since each ISIS minicourse is independent of the others, a new student may start with any topic you choose. (To keep equipment problems to a minimum, many teachers find it convenient for new students to begin with a minicourse that is already in use.)

The Poor Reader

ISIS has taken great care to make its minicourses fairly easy reading. The open, well-illustrated format, relatively large type face, short sentences, and conversational tone are some of the features that promote readability.

However, despite these efforts, some high school students have trouble reading the ISIS materials. Here are some tips on helping the poor reader.

1. Do not homogeneously group poor readers. Try to schedule classes such that the poor readers are exposed to good readers.
2. In classes with many poor readers, have the students work in pairs and pair the poor readers with good readers.
3. Do not force poor readers to work faster than their reading skills will permit. This produces frustration and withdrawal.
4. As a last resort, consider audiotaping the words in the minicourse booklets, and have the poor readers interact with the tapes rather than with the printed matter. This technique is not strongly advised because it destroys the possibility of improving reading through science.

Preliminary studies have suggested that poor readers improve their reading skills in the context of doing ISIS minicourses. The ISIS format and style stimulates students to try to read, and this practice can lead to reading gains. If you are interested in this aspect of ISIS, you might want to do a local study of reading gains among poor readers by administering a reading test before and after at least six months of exposure to ISIS minicourses.

Student's Notebooks

Research indicates that students learn better when they are asked to respond to questions about main ideas as they progress through learning materials. Thus, the ISIS activities have questions heavily interspersed throughout the text. Students should be required to answer all of these questions in writing.

But it is also important that students not spend long periods of time with the details and mechanics of answering questions. Ideally, students would answer questions directly in the minicourse. But because of cost, ISIS minicourses were designed not to be expendable. The best solution, then, is for you to produce duplicated answer sheets for each activity in the minicourse.

The answer sheets can be quite simple, containing just the question numbers and enough space for the student to respond in the case of single questions and a few key words and additional space in cases of multiple questions. The answer sheets should also include all tables, grids, diagrams, and other figures that students must respond to. Figures 8-1 below and 8-2 (page 55) show sample answer sheets from two minicourse activities.

Generation Link Answer Sheet
"Activity 9: Crossing Hybrids"

Name _____ Date _____

9-1. _____ 9-2. _____

9-3. _____ 9-4. _____

_____

9-5. _____

9-6. Yellow peas? _____

Green peas? _____

9-7. $\frac{\text{Yellow-pea combinations}}{\text{All possible combinations}}$ = _____

9-8. Round peas? _____

Wrinkled peas? _____

9-9. $\frac{\text{Round-pea combinations}}{\text{All possible combinations}}$ = _____

$\frac{\text{Wrinkled-pea combinations}}{\text{All possible combinations}}$ = _____

9-10. Yellow, round-pea combinations? _____

$\frac{\text{Yellow, round-pea combinations}}{\text{All possible combinations}}$ = _____

Figure 8-1

Physics of Sport Answer Sheet
"Activity 11: Learning New Skills"

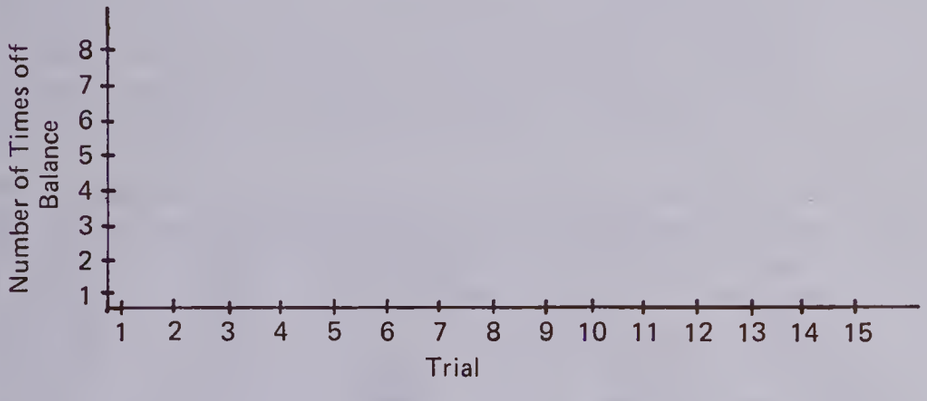
Name _____ Date _____

11-1. _____
11-2. _____
11-3. _____
_____

MASSED	TRIALS														
Subjects	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Average															

SPACED	TRIALS														
Subjects	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Average															

Figure 11-2



11-4. _____
_____
11-5. _____
11-6. _____
_____

Figure 8-2

Students would use answer sheets such as those in Figures 8-1 and 8-2 to record their answers and review for tests. They could be kept in the student's notebook or in a file folder available to the student if you're concerned about students copying one another's work.

Experience has shown, however, that students do not copy each other's answers to the questions in the minicourses as much as might be anticipated. And copying can be minimized by not emphasizing the responses to the questions and by using a nonthreatening attitude when checking answers.

If your local situation will not permit you to duplicate answer sheets, you'll need to set up some plan for students to respond to questions in their notebooks. Again, students should spend as little time as possible on the mechanics of answering questions. Here are a few suggestions that might help.

1. Tell students not to copy questions into their notebooks, but require them to number their answers so that they correspond to the minicourse question numbers.
2. Have standard graph paper available to simplify drawing grids.
3. Require students to title each page with the activity number and the minicourse title so that you can easily check them and the students can use them for review purposes.

Making Answers to Embedded Questions Available

Students must have feedback as to whether they have answered embedded questions correctly, drawn graphs properly, filled in tables appropriately, and completed diagrams as they should be. Ideally, they should have that kind of feedback on a daily basis, but certainly they will need it as they complete each activity. Without such feedback, wrong answers and misconceptions are reinforced and, hence, are very difficult to correct later.

Answers are not provided in the student's edition of the minicourses, but they are available in the ATEs. There are several ways to give your students access to the answers.

The most effective method, but also the most time-consuming to you, is to go over each group of activity answers with each student. Such brief, face-to-face sessions allow you to explain to the student why he or she missed certain parts and to suggest remedies. But be sure that students are not delayed in their progress by having to wait for the feedback sessions.

If time won't permit you to meet with each student, you could copy the answers to the questions from your ATEs and post them, minicourse by minicourse, for the students to check. Make several copies and post them in different areas to reduce waiting time. You might prefer to keep the copies in several file folders available to the students.

Another approach you could use is simply to make the ATEs available to the students in a special location and instruct the students about how to find the answers to their questions. Although this approach uses the least amount of your time, it has several disadvantages. It ties up the ATEs when you might need them, it allows students just one copy of the answers, and it gives students certain information in ATEs that you may not wish to make available to them.

No matter which approach you use to make answers available to students, it's best to check regularly to be sure students are checking their work and correcting their misconceptions.

Encouraging Resource Units

Students are often reluctant to use resource units. You'll need to direct them to do appropriate resource units when it is apparent that they are deficient in skills or information prerequisite to the completion of minicourse activities. Several suggestions about encouraging the use of resource units are given below.

1. Whenever you notice a student performing a skill incorrectly, hand the student the appropriate resource unit and say, "The right way to do that is explained here. I'll check you in a few minutes."
2. If a student asks you how to do something or about a certain concept that appears in one of the resource units, hand the student the appropriate resource unit and say,"It's explained here. I'll check with you in a few minutes."

3. Post a few attractive, heavily illustrated resource units on your bulletin board. Choose units that might appeal to students' interests.

4. Store the resource units in a very conspicuous and easily reached spot in the room. Provide a highly visible poster to attract attention to them.

5. Have a student assistant go through all minicourse booklets and underline the resource unit references in red ink. You might even want to stamp a large *important* in the margins next to all resource unit references.

6. Include some test questions about resource unit skills required in any activity. Some minicourse tests will already contain such questions. But, because the minicourse test only samples objectives, you may need to develop some additional items.

7. The primary way to get students to use resource units is probably to remind them constantly of their importance and their benefits.

ISIS strongly recommends that you do not have your class go through resource units at the beginning of the year. Such a practice defeats the benefits of individualization, gives students material when they are unaware of its relevance to their work and when they may already have the skill, and can be a very boring way to begin a program.

A Change of Pace

Any program, even one with the variety available in ISIS, can be tiring to students if there is never a change in the routine. In addition, some important elements of group learning and interaction are necessarily missing from any individualized instruction. For those reasons, you may, from time to time, want to set minicourses aside and have students pursue other activities. Some suggested types of activities follow.

1. Short research projects
2. Field trips to such places as auto repair shops, hospitals, or industrial labs
3. Guest speakers, such as politicians, pollution analysts, physicians, or school nurses
4. Surveys or polls of current concerns
5. Nature walks
6. Science films
7. Lecture–demonstrations of important concepts
8. Current events reports in the news
9. Reports on topics of student interest
10. Classroom demonstrations, such as CPR units demonstrated by trained technicians or fire safety demonstrations by fire fighters
11. Values clarification sessions
12. Debates about current science–social issues

Additional sources of ideas for various activities can be found in the ATEs. The front matter often provides suggestions for films, books, and projects that directly relate to the content of the minicourse.

You might want to use these change-of-pace activities one period a week or two or three days a month or perhaps at irregular intervals. If you can relate them directly to the minicourses in progress in your classroom at the time, that's beneficial. But if you cannot, use them anyway. Just be certain the activity is self-contained and will be understood by and of benefit to all of your students. Also, be sure to hold them responsible for the information imparted by the activity. Make sure students know it's not an entertainment break. Change of pace can be an important motivational technique.

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